WIND ENERGY RESOURCE ASSESSMENT
MESQUITE CREEK WIND PROJECT, TEXAS
PROPOSED BY BNB RENEWABLE ENERGY LLC
AND SUMITOMO CORPORATION OF AMERICA

submitted to

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SUMMARY

The Mesquite Creek project is located in Dawson and Borden Counties, in western Texas. It is planned for 118 GE 1.79/100 turbines with 80-m hub heights. These turbines have a rated power of 1.79 megawatts. The total nameplate rating of the wind farm is 211.22 MW. The developer is BNB Renewable Energy LLC (BNB Renewable) and Sumitomo Corporation of America (Sumitomo).

The project is located mostly on the flat Caprock plateau, with some turbines near the edge of the Caprock escarpment. Turbine elevations across Mesquite Creek range from 2855-2945 feet above mean sea level, with a very gradual descent from west to east. The terrain consists of a mix of agricultural and pasture lands, with few homes and few surface-based obstructions to the flow.

Wind data have been collected at Mesquite Creek since June 2005 when the first meteorological equipment was installed on an existing 137-m communications tower. In all, there have been seven on-site meteorological towers: four 50 m tall, two 60 m tall, and the communications tower, plus one SecondWind Triton sodar.

The meteorological campaign was conducted in two phases, first by a previous developer who operated four stations through 2008. BNB Renewable assumed the project in 2009 and has operated five stations plus the sodar.

The meteorological campaign provides good coverage of the Mesquite Creek project, considering its flatness and relatively uniform terrain. Predicted long-term mean annual hub-height wind speeds at the meteorological towers and the 118 turbines range from 7.7-8.3 mps, and the predicted aggregate long-term mean annual hub-height wind speed for the entire turbine array is 8.02 mps.

The on-site wind data have been used to generate representative annual wind speed frequency distributions for the Mesquite Creek project. These distributions have been combined with the GE-1.79/100 power curve valid at 1.09 kg/m^3 air density to simulate gross annual energy potential.

The predicted long-term mean annual gross capacity factor for the 118-turbine Mesquite Creek project is 52.92%.

A series of loss factor discounts is applied to convert the gross annual energy production into net production, based on engineering and meteorological inputs. A total discount of 17.38% has been applied, with a resulting long-term mean annual net capacity factor projection of 43.73%. At the time of this writing, we are waiting for documentation from GE concerning power curve documentation and certain discounts.

The Mesquite Creek project is benign with respect to turbulence. Characteristic turbulence at hub height (mean turbulence intensity plus one standard deviation in a 15-mps wind) ranges from 0.09-0.11.

The maximum observed 2-second gust at Mesquite Creek through November 2013 has been 44 mps. The predicted 50-year return 3-second peak gust at hub height is 49.1 mps, and the predicted 50-year return 10-minute mean wind speed at hub height is 35.8 mps.

There are no other existing wind farms within 20 km of Mesquite Creek. The existing Bull Creek and planned Stephens BorLynn Ranch projects are a further distance to the northeast of Mesquite Creek, and no measurable wake impact is expected from these projects.

Following are probability-of-exceedance values for Mesquite Creek, reflecting the expected performance and uncertainty of the wind farm. These refer to the ten-year and one-year energy production levels. Both net capacity factors (in percent) and actual net energy (in MWh) are given.

P-Value	Ten-Year NCF (%)	Ten-Year MWh	One-Year NCF (%)	One-Year MWh
P99	35.30	653,200	32.24	596,500
P95	37.74	698,200	35.56	657,900
P90	39.08	723,100	37.39	691,800
P75	41.26	763,400	40.36	746,800
P50	43.73	809,045	43.73	809,045
P25	45.85	848,400	46.85	866,900
P10	47.73	883,100	49.61	917,900

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1. INTRODUCTION

The Mesquite Creek project is located in Dawson and Borden Counties, in western Texas. It is planned for 118 GE 1.79/100 turbines with 80-m hub heights. These turbines have a rated power of 1.79 megawatts. The total nameplate rating of the wind farm is 211.22 MW.

The developer is BNB Renewable Energy LLC (BNB Renewable) and Sumitomo Corporation of America (Sumitomo).

The regional setting of Mesquite Creek is shown in Figure 1. The project is located mostly atop the Caprock plateau (also called the Llano Estacado) that extends from Midland to Amarillo in west Texas. Some turbines are near the escarpment of this plateau, where terrain breaks result in elevation changes up to 60 meters (200 feet).

Figure 1 also shows the locations of the three long-term reference stations (Lubbock, Midland and Abilene airports) used to help establish long-term winds at Mesquite Creek.

Figure 2 is a topographic map of the Mesquite Creek project, meteorological towers, and the prospective 118-turbine array. Turbine elevations across the project range from 2855-2945 feet above mean sea level, with a very gradual descent from west to east. The project footprint contains a mix of agricultural and pasture lands, with few homes and surface-based obstructions to affect wind flow.

The first meteorological station (Site 6341) was instrumented in June 2005 on a representative communications tower. This tower has hub-height measurements and since 2009, wind data recorded up to 120 m above ground. Three 60-m towers were added in 2006. There is a gap in data collection from Fall 2008 to Summer 2009, at which time BNB Renewable re-instrumented Site 6341, one of the other original towers, and added a third tower. Two 60-m towers and a sodar were added in 2013 to augment the wind monitoring network and provide representative wind data across the entire project footprint.

The on-site and reference station wind data provide a sound basis for the wind resource assessment presented in this report.

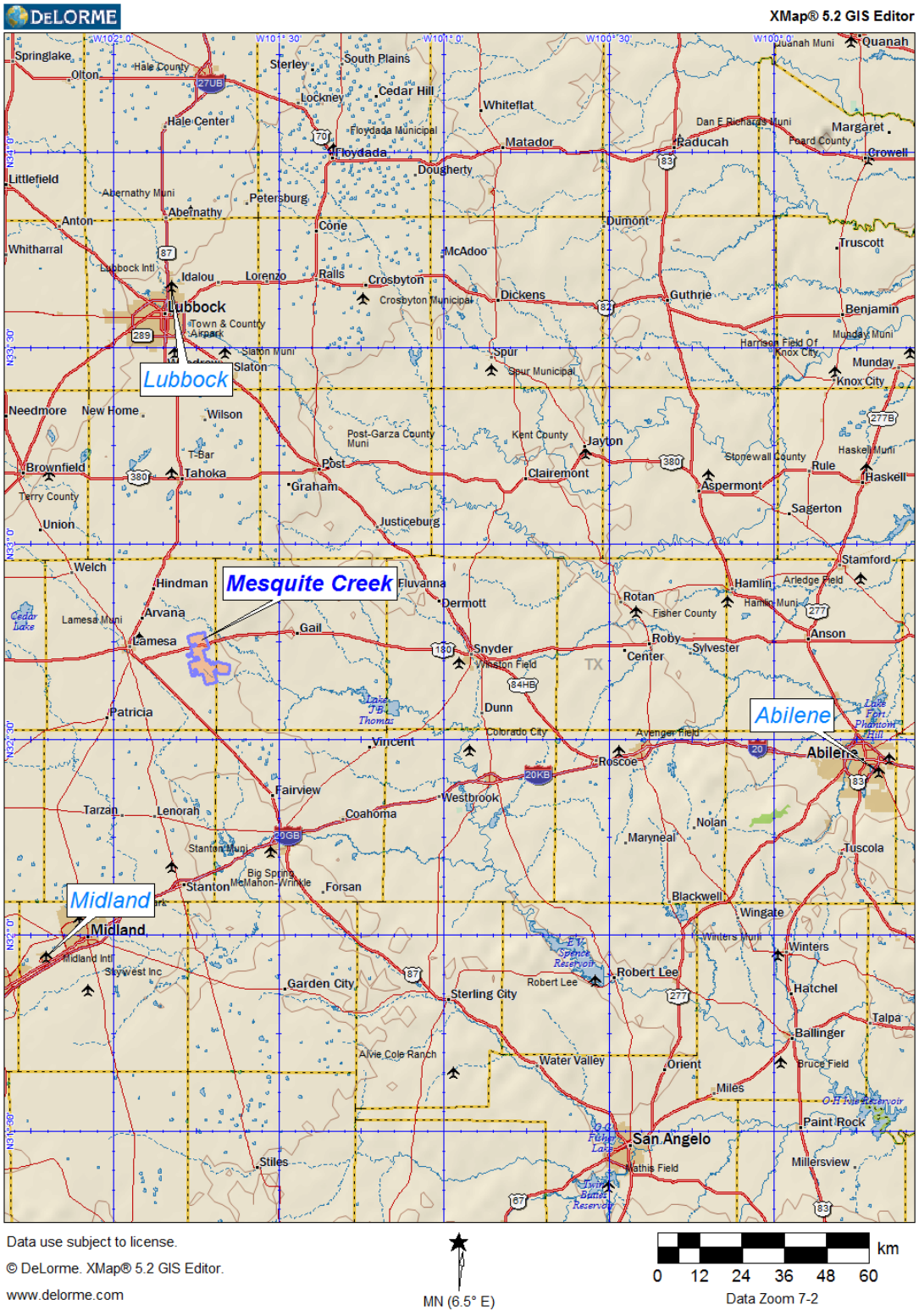

Figure 1. Regional Map of the Mesquite Creek Project and Long-Term Reference Stations

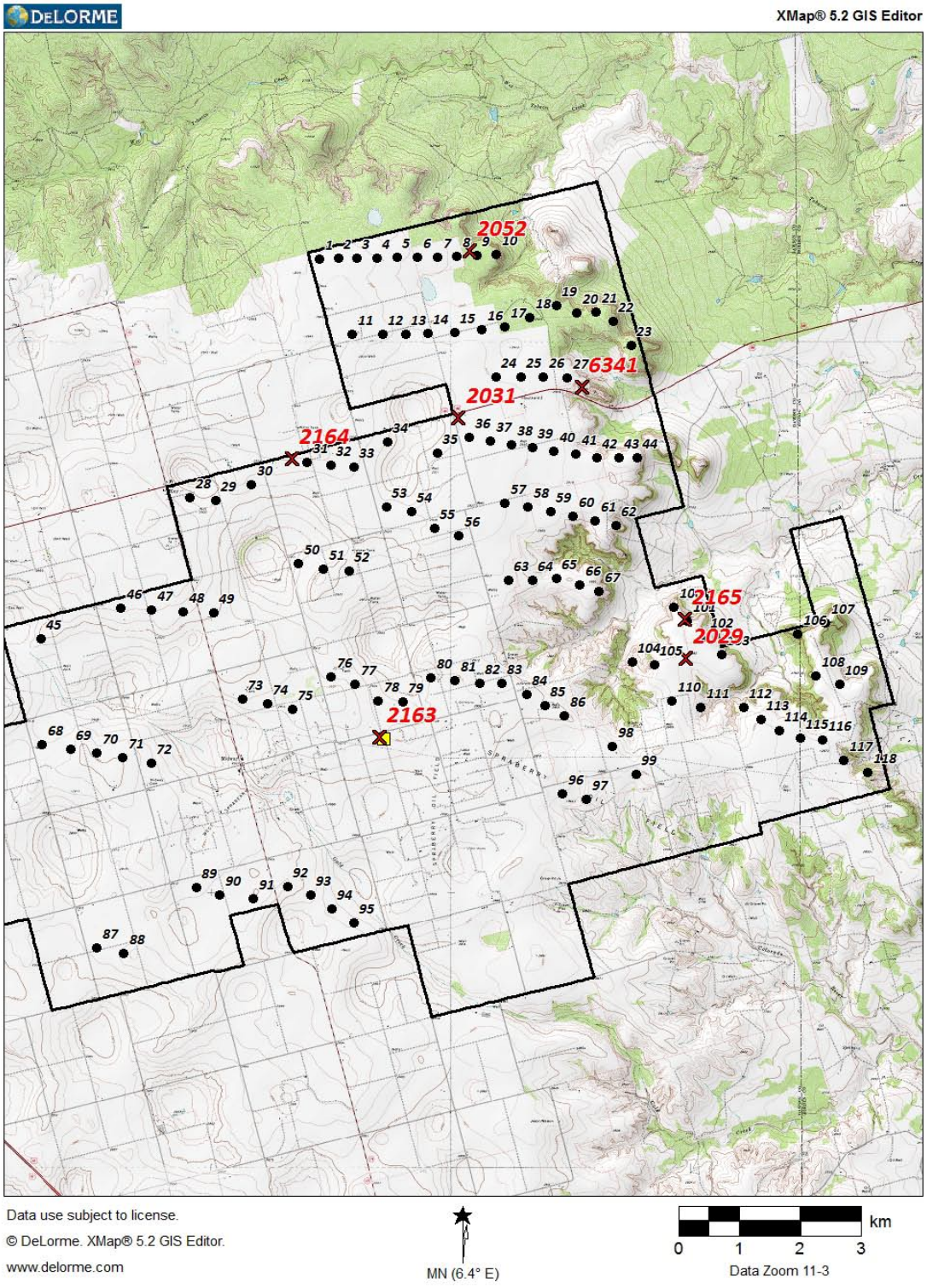

Figure 2. Mesquite Creek Project Footprint, Meteorological Towers (red X's), and the Prospective GE-1.79/100 Turbine Array

2. GE-1.79/100 WIND TURBINE

The GE-1.79/100 wind turbine is a three-bladed upwind turbine. For the Mesquite Creek project, its hub height will be 80 m, and its rotor diameter will be 100 m. It should be noted that GE refers to this turbine as the 1.7-100, but we've relabeled it for purposes of this report to distinct it from that previous turbine model.

For purposes of calculating the turbine power curve, on-site air density was estimated based on climatological records in the region. The temperature and pressure data we considered represent a 30-year period from three nearest National Weather Service first-order weather stations, the Abilene, Lubbock and Midland airports. The average turbine elevation at Mesquite Creek is 2911 feet (887 m) above sea level, to which an additional 80 m is added for hub height, making a total of 967 m. Starting with the airport station air densities, the typical air density adjustment for elevation, 0.01 kg/m³ for every 100 m, is applied to estimate effective Mesquite Creek air density, as shown in Table 1.

Table 1. Climatological Stations and Parameters for Air Density Calculations

Station	Elevation (m)	Mean Temperature (°C)	Mean Station Pressure (mb)	Air Density at Site (kg/m³)	Air Density Adjusted for Mesquite Creek
Abilene	545	18.1	953.0	1.140	1.098
Lubbock	993	15.5	904.0	1.091	1.094
Midland	873	17.5	916.4	1.099	1.089

The three "adjusted" Mesquite Creek annual air densities average 1.094 kg/m³. We have adjusted this value down by 0.01 kg/m³ (due to the presence of nocturnal temperature inversions, in which temperatures are higher at hub height than at the ground, and therefore annual hub-height air density is less than measured at the surface) and then back up to 1.09 kg/m³ to reflect the seasonality of wind potential (colder months are windier than the warmer months). These adjustments to the project annual mean air density are consistent with other west Texas project sites.

The GE-1.79/100 power curve for the Mesquite Creek project is given in Table 2. It has been derived from recently published power curves by GE for this turbine model, linearly interpolating between air densities of 1.08 and 1.10 kg/m³. This single curve is used for all turbines, representing the weighted average turbine elevation. Using a weighted average turbine elevation is common practice in wind resource reports. The range of turbine elevations yields air densities that differ by less than 0.3%, which is considered a small difference across the project footprint.

Table 2. GE-1.79/100 Power Curve for 1.09 kg/m³ Air Density*

Speed (mps)	Power (kW)	Speed (mps)	Power (kW)	Speed (mps)	Power (kW)
0	0.0	9	1412.0	18	1790.0
1	0.0	10	1727.5	19	1790.0
2	0.0	11	1789.0	20	1790.0
3	0.0	12	1790.0	21	1790.0
4	78.0	13	1790.0	22	1790.0
5	214.0	14	1790.0	23	0.0
6	402.0	15	1790.0	24	0.0
7	656.5	16	1790.0	25	0.0
8	995.5	17	1790.0	26+	0.0

*at the time of this writing, we understand that GE, BNB Renewable and Sumitomko have finalized the power curve contractually, and we are awating formal paperwork to that effect. The standard published power curve is given in the following undated document:

Technical Documentation, Wind Turbine Generator Systems, 1.7-100 – 50 Hz and 60 Hz, Calculated Power Curve and Thrust Coefficient, Document ID:

1.7-100_xxHz_PCD_allComp_xxxxxxxxxxxx.ENxxx.05.docx.

3. WIND DATA

Wind measurements at the Mesquite Creek project commenced in June 2005 with the instrumentation of a tall communications tower, which was given a site number of 6341.

Table 3 summarizes key information about the Mesquite Creek meteorological towers and sodar, including their names, coordinates and wind speed measurement heights. Figure 2 shows their locations. Of the total seven towers, five are still in operation as of November 2013. Complete documentation of the Mesquite Creek meteorological towers and sodar is given in Appendix A.

Table 3. Mesquite Creek Meteorological Towers (WGS84 Datum)

Site	Date of First Data	Latitude (°N)	Longitude (°W)	Elevation (m ASL)	Wind Speed Levels (m)	Months of Data
6341	22 Jun 2005	32° 44.592'	101° 43.654'	888	38/56/76 to 2008; add 15/118/120 in 2009	90
2031	4 May 2006	32° 44.312'	101° 44.946'	893	20/40/60 to 2008; then removed	29*
2029	18 Jun 2006	32° 42.131'	101° 42.569'	878	20/40/60 to 2008; then removed	8**
2052	2 Nov 2006	32° 45.827'	101° 44.824'	888	20/40/59 to 2008; 10/30/50 from 2009	74
2163	9 Nov 2009	32° 41.413'	101° 45.767'	887	10/30/50	48
2164	7 Mar 2013	32° 43.941'	101° 46.677'	886	10/32/50/59	9
2165	21 Aug 2013	32° 42.483'	101° 42.587'	881	10/32/50/59	3
Sodar	7 Jun 2013	32° 41.380'	101° 45.719'	886	40-200	6***

** data from Site 2031 are inconsistent with the rest of the monitoring network and have been ignored for purposes of this wind resource assessment*
*** too little data from Site 2029 to be reliable, but nearby Site 2165 installed in 2013 in its place*
**** sodar is 97 m southeast of Site 2163 in similar exposure*

Site 6341 is a 137-m tall communications tower with 36-inch face width and boom lengths of 60.5 inches to 2008 and 74 inches starting 2009. The 118-m level anemometer has a 180-inch boom. Comparative statistics between the 118-m and 120-m booms suggest sufficient similarity such that the winds from this tower can be considered generally reliable, in spite of the fact that its boom lengths (other than at 118 m) are much closer than IEC guidelines recommend.

The meteorological towers are NRG tall towers. The 50-m towers have a constant diameter of 6 inches. The 60-m towers have diameters of 10" to 30 m and 8" above 30 m. NRG Symphonie or Symphonie PLUSdata loggers and NRG #40C anemometers have been used at all towers. V-Bar has confirmed the location and configuration of all currently active towers in the field.

The NRG #40C anemometers were individually calibrated off-site prior to their field deployment. Per guidance from the manufacturer of the anemometers, Renewable NRG Systems, all wind data for Mesquite Creek were processed using the NREL (National Renewable Energy Laboratory) default calibration constants: slope 0.765 mps/Hz; offset 0.35

mps. The use of these default constants stems from the fact that the actual and default calibration constants are nearly identical, and the resulting conclusion by NREL and NRG Systems that the slight discrepancies are as likely due to uncertainties in the wind tunnel testing as they are to true differences among the sensors.

The anemometers installed by BNB Renewable at Sites 6351, 2052 and 2163 were removed from the field in February 2013 and post-calibrated in the Svend Ole Hansen wind tunnel on 6 May 2013. A number of anemometers had degraded by more than 1% from the NREL default calibration constants:

Site	Anemometers Tested	Number Degraded > 1%	Worst Degradation (%)
6341	15, 38, 76 m	2	1.18
2052	10-se, 10-w, 30-se, 30-w	4	1.60
2163	10-se, 10-w, 30-se	0	0.69

We kept the data as recorded by the degraded anemometers, understanding that this adds a slight conservatism to their long-term winds.

Long-term reference wind speed data were obtained for three regional ASOS (Automated Surface Observation System) stations, the Abilene, Lubbock and Midland airports. These stations are also National Weather Service first-order stations, and they collect digital data round the clock and receive a high level of maintenance.

The monthly mean wind speed histories of these three stations are given in Tables 4a-4c. Their data start in 1996, giving an average 17.3-year period of record.

These reference stations were converted from cup to sonic anemometry in 2005-2007. Cup and sonic anemometers have different response characteristics, and one cannot combine their data sets to determine long-term winds without accounting for this difference.

V-Bar presented a paper on the cup to sonic conversion at the American Wind Energy Association's fall wind resource assessment workshop in Portland, Oregon in September 2008. Excerpts from that paper are given in Appendix B. This comparative study showed that on average, mean wind speeds with sonic anemometers average 3.7% less than with cup anemometers, which we have conservatively rounded up to 4%. The data in blue font in Tables 4a-4c are the "sonic-equivalent" mean wind speeds when these stations had cup anemometers. Thus the mean wind speeds taken from the original cup anemometer measurements were reduced by 4% to derive "sonic-equivalent" wind speeds.

Various comparative studies have validated the general accuracy of the 4% sonic adjustments to Abilene, Lubbock and Midland. All uncertainties in these adjustments are accounted for in the probability analyses at the end of this report.

Table 4a.
Sonic-Equivalent Monthly Mean 10-m Wind Speeds (mps)
Abilene Airport, Texas
ASOS Period Only
Sonic Conversion Date: 29 January 2009
Cup mean speeds decreased by 4%

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1996					6.9	4.3	4.0	3.8	3.5	4.6	4.6	5.1	
1997	4.8	4.6	4.8	5.5	4.6	4.2	4.3	3.9	4.1	4.5	4.2	4.3	4.47
1998	4.6	4.5	5.8	5.2	5.3	6.4	4.7	3.5	3.8	5.1	4.5	3.9	4.77
1999	5.1	5.2	5.2	5.8	5.4	5.5	5.1	3.6	4.5	4.3	4.2	4.7	4.87
2000	4.8	5.2	5.8	5.8	6.3	5.0	4.5	4.4	4.0	5.2	3.9	4.5	4.94
2001	4.3	5.0	4.0	5.5	5.3	5.5	4.6	3.9	3.9	5.2	4.8	4.3	4.68
2002	4.7	5.1	5.8	5.1	5.8	5.0	4.3	4.6	3.5	3.8	4.1	4.7	4.71
2003	4.4	5.0	4.9	6.0	4.7	4.4	4.2	3.7	4.1	3.8	5.1	5.3	4.63
2004	4.8	5.0	4.9	5.1	5.6	4.9	4.4	3.9	3.8	3.9	4.3	4.5	4.59
2005	4.3	3.8	4.9	5.4	4.7	5.1	4.3	3.5	4.0	3.9	4.4	4.3	4.39
2006	5.1	4.8	5.5	5.3	5.3	4.3	4.4	3.9	4.1	4.6	4.9	4.6	4.73
2007	3.6	5.2	5.1	5.5	4.0	4.1	3.0	3.9	3.9	4.7	4.5	4.6	4.34
2008	5.2	5.3	5.7	6.0	5.5	5.9	4.6	3.2	3.4	4.5	4.4	5.2	4.90
2009	4.6	5.8	6.0	6.7	4.5	5.1	4.0	4.3	3.9	4.8	3.8	4.0	4.77
2010	4.7	4.4	5.9	6.1	4.8	5.2	4.1	3.7	4.0	3.7	5.3	4.5	4.70
2011	4.0	5.3	5.5	6.2	6.2	6.5	4.5	4.1	3.5	4.8	5.2	4.3	5.01
2012	4.9	5.1	5.3	5.2	5.3	5.1	4.1	3.9	4.2	4.4	4.4	4.8	4.73
2013	4.1	5.1	5.6	6.4	5.9	5.1	3.9	3.8	3.7	4.5	4.7		
Overall	4.59	4.97	5.34	5.70	5.33	5.08	4.27	3.87	3.87	4.46	4.51	4.55	4.71

Table 4b.
Sonic-Equivalent Monthly Mean 10-m Wind Speeds (mps)
Lubbock Airport, Texas
ASOS Period Only
Sonic Conversion Date: 11 April 2007
Cup mean speeds decreased by 4%

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1996							4.0	3.9	3.9	4.9	5.4	5.6	
1997	5.4	5.1	5.6	6.2	5.8	5.2	5.0	3.9	4.1	4.8	4.4	5.1	5.05
1998	5.4	4.8	6.0	5.9	5.4	6.4	4.6	3.7	3.9	5.1	4.8	4.6	5.04
1999	5.5	5.6	5.8	6.8	5.7	5.8	5.2	3.6	4.5	4.6	4.1	5.1	5.18
2000	5.5	5.5	6.3	6.2	6.4	5.6	4.5	4.2	4.6	5.0	4.5	4.7	5.25
2001	4.7	5.1	4.9	6.2	5.4	5.9	4.7	3.9	4.4	5.2	4.9	4.9	5.02
2002	5.1	5.6	6.4	5.9	6.4	5.9	4.5	5.1	4.0	4.5	4.6	4.8	5.23
2003	4.9	5.4	5.7	6.4	5.8	5.2	5.0	4.4	4.9	4.6	5.5	5.5	5.26
2004	4.9	5.2	5.9	5.8	6.3	5.5	4.6	4.3	4.6	4.5	4.8	4.9	5.09
2005	4.6	4.4	5.7	6.0	5.4	6.0	4.6	3.9	4.4	4.2	4.8	4.7	4.89
2006	5.5	5.4	6.2	6.1	5.4	5.3	4.5	4.3	4.4	4.9	5.0	4.9	5.16
2007	4.7	5.5	5.1	5.7	4.9	4.7	3.6	4.7	4.3	5.2	4.4	5.0	4.83
2008	5.7	5.6	6.7	6.4	5.8	6.3	4.7	3.9	3.6	4.7	4.8	5.4	5.30
2009	5.0	5.7	6.3	6.9	5.2	5.0	4.4	4.6	4.1	5.1	4.4	4.2	5.08
2010	4.8	4.7	6.3	6.9	6.1	5.9	4.4	4.0	4.3	4.1	5.1	4.7	5.11
2011	4.5	5.6	5.4	6.7	6.4	7.0	4.7	4.4	4.0	5.0	5.3	4.8	5.34
2012	5.6	5.9	5.9	6.0	5.7	5.9	4.5	4.3	4.1	4.9	4.8	5.3	5.23
2013	4.7	5.6	5.8	6.3	6.3	6.4	4.9	4.1	4.4	5.0	5.2		
Overall	5.08	5.34	5.88	6.26	5.79	5.76	4.57	4.18	4.25	4.79	4.81	4.94	5.14

Table 4c.
Sonic-Equivalent Monthly Mean 10-m Wind Speeds (mps)
Midland Airport, Texas
ASOS Period Only
Sonic Conversion Date: 11 April 2007
Cup mean speeds decreased by 4%

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1996			5.2	5.6	6.2	4.8	4.3	4.1	3.8	4.5	4.5	4.3	4.68
1997	4.6	4.4	4.7	5.5	5.0	4.8	4.6	3.7	3.7	4.7	3.7	4.5	4.49
1998	4.1	4.4	5.5	4.9	4.6	5.7	4.4	4.1	4.1	5.1	4.3	4.2	4.62
1999	4.7	4.8	5.1	5.8	5.5	5.5	5.3	3.4	4.3	3.9	3.6	4.3	4.68
2000	4.2	4.8	5.3	5.7	5.5	5.5	4.7	4.3	4.0	5.2	3.9	4.3	4.79
2001	4.5	4.4	4.3	5.4	5.2	5.4	4.8	4.0	4.3	4.8	4.0	4.1	4.59
2002	4.2	4.7	5.4	5.1	6.0	5.5	4.7	5.1	4.0	4.3	4.0	3.8	4.73
2003	3.9	4.7	4.9	5.5	4.8	5.0	4.5	4.4	4.6	4.0	4.7	4.5	4.61
2004	4.2	4.9	5.3	5.1	5.7	5.3	4.8	4.3	4.4	3.9	4.3	4.3	4.71
2005	4.1	3.8	4.8	5.2	4.6	5.2	4.5	3.9	4.2	4.0	4.0	4.1	4.36
2006	4.6	4.3	5.1	5.3	5.2	4.6	4.5	3.7	4.1	4.3	4.2	4.1	4.50
2007	4.1	4.8	4.4	5.4	4.3	4.5	3.6	4.5	4.0	4.6	3.7	4.2	4.34
2008	4.2	4.8	5.6	5.4	5.7	6.2	5.0	3.6	3.0	4.1	3.7	4.5	4.65
2009	4.3	5.1	4.9	6.0	4.7	4.6	3.7	3.7	3.6	4.5	3.4	3.7	4.34
2010	4.1	4.4	5.8	5.8	5.5	5.5	4.7	4.2	4.1	4.0	4.5	4.2	4.72
2011	3.9	4.8	5.1	6.2	5.9	6.3	4.8	4.3	4.0	4.7	4.9	4.6	4.94
2012	4.6	5.3	5.3	5.4	5.1	5.6	4.5	4.4	4.4	4.4	3.9	4.5	4.78
2013	4.1	5.0	5.3	5.9	6.1	6.2	4.9	4.5	4.4	4.6	4.6		
Overall	4.23	4.68	5.10	5.51	5.31	5.34	4.56	4.13	4.06	4.41	4.09	4.24	4.64

The complete monthly mean wind speed history for all Mesquite Creek meteorological towers is given in Appendix C. Data are presented by year, and we have processed data through November 2013. All values reflect the "full-month" estimates when data recovery is less than 100%, with overall wind speed ratios to other towers or other levels on the same tower having 100% recovery used for extrapolation. Monthly data recovery is indicated in these tables as well with a color coding.

V-Bar has applied our full complement of objective and qualitative editing procedures to the Mesquite Creek wind data. Data recovery was modest prior to 2009 when BNB Renewable assumed the project, and data recovery has been excellent from 2009-2013.

The 90 months of on-site wind records combined with the 17 years of reference data give a suitable basis for evaluating long-term mean annual wind speeds at the Mesquite Creek meteorological towers. To assess the merits of Abilene, Lubbock and Midland as long-term reference stations, we examined correlation coefficients of their daily mean wind speeds to Mesquite Creek. Lubbock is the best correlated of the three stations, with an average correlation coefficient of 0.88 ($r^2 = 0.78$) to the four longest-running currently active met towers. Midland

has an average daily correlation coefficient of 0.84 (r^2 =0.70), followed by Abilene at 0.80 (r^2 = 0.64).

Given the long periods of record, we have estimated long-term mean annual wind speeds at the Mesquite Creek meteorological towers using two techniques. We first estimated the long-term winds at Site 6341 using its 90-month data history to calculate its composite mean monthly and annual wind speeds, without considering the reference stations. We then considered the Site 6341 composite mean annual wind speed ratios to the reference stations to calculate a correlated mean annual wind speed. Estimated long-term winds for the other Mesquite Creek meteorological towers were based on their mean wind speed ratios to Site 6341.

These techniques and results are presented in detail below.

Composite monthly and annual mean wind speeds at Site 6341 were computed by averaging all January data together, all February data, etc. This technique is also referred to in the wind industry as the mean of the means. Table 5 shows the composite mean monthly and annual winds for Site 6341 and the reference stations from June 2005-November 2013.

Table 5. Composite Mean Wind Speeds (mps), June 2005-November 2013

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38	7.5	7.6	7.9	8.0	7.3	7.0	5.8	5.7	5.6	6.7	7.2	7.4	6.97
	56	8.1	8.2	8.5	8.7	7.8	7.7	6.4	6.3	6.2	7.4	7.9	8.0	7.60
	76	8.7	8.7	9.1	9.2	8.3	8.2	6.8	6.7	6.6	7.9	8.5	8.5	8.11
Abilene	10	4.5	5.0	5.5	5.8	5.3	5.1	4.1	3.8	3.8	4.4	4.6	4.4	4.71
Lubbock	10	5.1	5.5	5.9	6.3	5.8	5.8	4.5	4.3	4.2	4.8	4.9	4.8	5.15
Midland	10	4.2	4.8	5.2	5.6	5.4	5.4	4.5	4.1	4.0	4.4	4.1	4.2	4.66

Table 6 combines the above information, plus composite mean annual wind speed ratios of Site 6341 to the reference stations, to predict long-term mean annual wind speeds at Site 6341. Note that wind speeds are shown based on each of:

- The stand-alone composite mean wind speeds at Site 6341 (6.97 mps at 38 m, 7.60 mps at 56 m, and 8.11 mps at 76 m)
- The estimated wind speeds based on correlation to the Abilene reference station (6.96 mps at 38 m, 7.59 mps at 56 m, 8.11 mps at 76 m)
- The estimated wind speeds based on correlation to the Lubbock reference station (6.95 mps at 38 m, 7.58 mps at 56 m, 8.10 mps at 76 m)
- The estimated wind speeds based on correlation to the Midland reference station (6.94 mps at 38 m, 7.57 mps at 56 m, 8.08 mps at 76 m)

The three estimates are combined to yield a weighted-average result by weighting the stand-alone value 50%, the Abilene correlation value 15%, the Lubbock correlation value 20%, and the Midland correlation value 15%. The rationale for this weighting incorporates the periods of record of all four stations and the correlation strength of the reference stations. It is noted that the four individual estimates agree within 0.5%, which is extremely consistent.

Table 6. Estimated Long-Term Mean Annual Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

Site	Level (m)	Composite Mean Jun 2005 to Nov 2013	Estimated Long-Term Based on… Abilene	Lubbock	Midland	Combined*	Shears Levels (m)	Exponent	Extrapolated to 80 m
6341	38-sw	6.97	6.96	6.95	6.94	6.96	38-56	0.222	
	56-sw	7.60	7.59	7.58	7.57	7.59	56-76	0.218	
	76-sw	8.11	8.11	8.10	8.08	8.10	38-76	0.220	8.20
Abilene	10-sonic	4.71	4.71						
Lubbock	10-sonic	5.15		5.14					
Midland	10-sonic	4.66			4.64				

** weights of 50% for the actual composite mean, 20% for Lubbock, and 15% each for Abilene and Midland*

Long-term mean annual wind speeds for Sites 2052 were estimated from their composite mean annual wind speed ratios to Site 6341. These results are shown in Table 7, noting the two separate periods and tower configurations, yet excellent agreement between the two methods.

Table 7. Estimated Long-Term Mean Annual Wind Speeds
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

Site	Level (m)	Overall Mean Nov 2006 to Sep 2008	Estimated Long-Term	Shears Levels (m)	Exponent	Extrapolated to 80 m
2052	20	5.98	6.04	20-40	0.209	
	40	6.91	6.98	40-58	0.238	
	58-w	*invalid data*				
	58-e	7.55	7.63	20-58	0.219	8.18
6341	75.6-sw	8.03	8.10			

Site	Level (m)	Composite Mean Jul 2009 to Nov 2013	Estimated Long-Term	Shears Levels (m)	Exponent	Extrapolated to 80 m
2052	10-se	5.42	5.39			
	10-w	5.43	5.40	10-30	0.203	
	30-se	6.77	6.74	30-50	0.202	
	30-w	6.79	6.75			
	49.6-se	7.50	7.46	10-50	0.203	8.23
	49.6-w	7.52	7.48			
6341	76.2-sw	8.15	8.10			

Long-term mean annual wind speed estimates for Sites 2163 and 2164 are based on their composite or overall mean annual wind speed ratios to Site 6341. These data are shown in Table 8:

Table 8. Estimated Long-Term Mean Annual Wind Speeds
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

Site	Level (m)	Composite Mean Nov 2009 to Nov 2013	Estimated Long-Term	Shears Levels (m)	Shears Exponent	Extrapolated to 80 m
2163	10-se	5.19	5.16			
	10-w	5.20	5.17	10-30	0.217	
	30-se	6.60	6.56	30-50	0.216	
	30-w	6.59	6.56			
	49.6-se	7.31	7.27	10-50	0.217	8.11
	49.6-w	7.39	7.36			
6341	76.2-sw	8.14	8.10			

Site	Level (m)	Overall Mean Mar 2013 to Nov 2013	Estimated Long-Term	Shears Levels (m)	Shears Exponent	Extrapolated to 80 m
2164	10-w	5.50	5.52	10-32	0.195	
	32-w	6.76	6.91	32-50	0.182	
	32-se	6.78	6.93	50-59	0.204	
	50-w	7.37	7.50			
	59.2-w	7.62	7.75	10-59	0.192	8.23
	59.2-se	7.64	7.78			
6341	14.9-sw	5.60	5.62			
	38.1-sw	6.81	6.96			
	56-sw	7.45	7.59			

Here is the summary of long-term estimated mean annual 80-m winds at the Mesquite Creek meteorological towers:

- Site 6341, 8.20 mps (caprock edge)
- Site 2052, 8.21 mps (north end of project, near caprock edge)
- Site 2163, 8.11 mps (south-central part of project)
- Site 2164, 8.23 mps (northwest corner of project)

No long-term estimates are made for Site 2031 (winds 5% less than expected, and these are historical data with no way to check or validate the station) or Site 2029 (very limited data record with several seasons not represented). Initial long-term 80-m wind speed estimates for Site 2165 (3+ months of data are 8.2-8.4 mps.

4. TURBINE ARRAY

The prospective 211.22-MW turbine array for Mesquite Creek is shown on Figure 2 in the introduction, and Appendix D lists the coordinates for the 118 GE-1.79/100 turbine sites in the array.

Given the relative simplicity and consistency of the terrain, little variation in wind resource is anticipated across the project footprint. The lower winds assigned to some of the southern and southeastern turbines reflect their exposure (normally) downwind of the southern edge of the local Caprock escarpment. Gravitational effects on the flow in stable, nocturnal conditions tend to slow winds rising up to the Caprock plateau, and also accelerate such winds as they descend off the plateau.

Long-term mean annual hub-height wind speed projections have been made in Table 9 for each individual turbine, reflecting its elevation and exposure with respect to the general and local topography and with respect to observed data from the Mesquite Creek meteorological towers. We have modeled these speeds using the V-Bar internal model, and can offer to run our mesoscale model, which is the most sophisticated model being run in the wind industry today.

The predicted aggregate long-term mean annual hub-height wind speed for the entire array is 8.02 mps, and the range of individual turbines is 7.7-8.3 mps.

Previous analyses by GE for similar arrays have given acceptance of this array concept, with no operating restrictions like wind direction sector management. At the time of this writing, we have not received documentation from GE confirming this for the array plan analyzed in this report.

Table 9. Modeled Long-Term Mean Annual 80-m Wind Speeds, Mesquite Creek

Turbine	Speed (mps)
1	8.3
2	8.3
3	8.3
4	8.3
5	8.2
6	8.2
7	8.2
8	8.2
9	8.2
10	8.2
11	8.1
12	8.1
13	8.0
14	8.0
15	8.0
16	8.0
17	8.0
18	8.1
19	8.2
20	8.3
21	8.3
22	8.1
23	8.3
24	8.0
25	8.0
26	8.1
27	8.2
28	8.1
29	8.1
30	8.1
31	8.2
32	8.1
33	8.1
34	7.9
35	8.0
36	8.0
37	8.0
38	8.0
39	8.0
40	8.0

Turbine	Speed (mps)
41	8.0
42	8.1
43	8.1
44	8.1
45	8.0
46	8.2
47	8.1
48	8.0
49	8.0
50	7.9
51	8.0
52	7.9
53	8.0
54	8.0
55	8.0
56	8.0
57	8.0
58	8.0
59	8.0
60	7.9
61	8.0
62	8.0
63	8.0
64	8.0
65	8.0
66	8.0
67	8.0
68	7.9
69	8.0
70	8.1
71	8.1
72	7.9
73	8.0
74	8.0
75	8.0
76	8.0
77	8.0
78	8.0
79	7.9
80	8.0

Turbine	Speed (mps)
81	8.0
82	8.0
83	8.0
84	8.0
85	8.0
86	8.0
87	8.0
88	8.0
89	8.0
90	7.9
91	7.9
92	8.0
93	7.9
94	7.8
95	7.8
96	7.8
97	7.7
98	8.0
99	7.8
100	8.2
101	8.2
102	8.2
103	8.2
104	7.8
105	7.9
106	8.1
107	8.0
108	7.8
109	7.9
110	7.9
111	7.8
112	7.9
113	7.9
114	7.9
115	7.9
116	7.9
117	7.8
118	7.8
Overall	8.02

5. GROSS ENERGY SIMULATIONS

Hourly mean wind speed data from Sites 6341, 2052 and 2031 were extrapolated to 80 m and compiled into a single wind speed frequency distribution. Weighting of 70% was assigned to Site 6341 given its longer period of record, and weightings of 15% each were assigned to the other sites, the goal being to obtain the most representative wind speed frequency distribution for Mesquite Creek.

This distribution was scaled to integer mean annual wind speeds of 7-9 mps, bracketing the range of winds across the wind farm, and normalized to a single, 8760-hour year. These distributions were combined with the GE-1.79/100 power curve to simulate gross annual energy potential for Mesquite Creek.

Table 10 shows these simulations. Here is a summary of gross annual capacity factors in percent as a function of annual mean wind speed, taken from the bottom lines of Table 10.

Mean Speed (mps)	Gross Capacity Factor (%)
7.0	42.66
8.0	52.78
9.0	61.30

Long-term mean annual gross capacity factor projections for each of the 118 Mesquite Creek turbines are computed from interpolation of Table 10. These results are shown in Table 11. The aggregate long-term mean annual gross GE-1.79/100 capacity factor projection for the Mesquite Creek project is 52.92%.

Table 10. Gross Annual Energy Simulations
Mesquite Creek, Texas, Sites 6341, 2052 and 2163*
BNB Renewable Energy LLC/Sumitomo Corporation of America
Turbine: GE-1.79/100 (power curve for low turbulence)
Air Density: 1.09 kg/m³

	Hours/Year at Mean Speed of:				Energy (kWh) at Mean Speed of:		
Speed (mps)	7 mps	8 mps	9 mps	Power (kW)	7 mps	8 mps	9 mps
0	11.4	8.6	6.9	0	0	0	0
1	112.4	80.6	60.3	0	0	0	0
2	314.4	223.9	164.0	0	0	0	0
3	603.5	423.9	314.4	0	0	0	0
4	878.3	658.2	496.2	78	68,511	51,343	38,703
5	1076.2	846.6	660.7	214	230,316	181,163	141,385
6	1162.2	966.6	800.6	402	467,216	388,592	321,835
7	1085.7	1018.0	870.5	657	712,744	668,325	571,516
8	954.5	954.4	903.4	996	950,240	950,151	899,322
9	756.6	853.3	850.3	1412	1,068,340	1,204,909	1,200,596
10	594.6	706.7	774.3	1728	1,027,099	1,220,884	1,337,650
11	448.5	570.7	658.1	1789	802,427	1,020,893	1,177,290
12	331.4	452.7	540.7	1790	593,237	810,410	967,908
13	209.3	351.8	449.6	1790	374,708	629,698	804,774
14	120.8	263.5	358.7	1790	216,171	471,619	642,156
15	59.0	168.8	290.2	1790	105,627	302,071	519,417
16	24.1	106.6	215.7	1790	43,071	190,899	386,118
17	8.5	56.1	141.5	1790	15,286	100,429	253,366
18	4.4	26.3	94.4	1790	7,902	47,032	168,946
19	2.0	11.1	53.6	1790	3,633	19,929	96,021
20	1.2	6.0	28.6	1790	2,166	10,654	51,181
21	0.4	2.0	12.9	1790	771	3,650	23,159
22	0	1.8	5.9	1790	0	3,304	10,612
23	0.2	1.0	4.0	0	0	0	0
24	0.1	0.3	1.5	0	0	0	0
25	0	0	1.6	0	0	0	0
26+	0.0	0.4	1.4	0	0	0	0
Total	8760.0	8760.0	8760.0		6,689,467	8,275,956	9,611,956
				GCF (%):	42.66	52.78	61.30

**Site 6341 data June 2005-June 2013, 76-m level. Site 2052 data, August 2009-July 2013, extrapolated to 80 m. Site 2163 data, November 2009-October 2013, extrapolated to 80 m. Weighting 70% for Site 6341, 15% each for Sites 2052 and 2163.*

Table 11. Gross Annual GE-1.79/100 Capacity Factor Projections (%)

Turbine	GCF (%)
1	55.3
2	55.3
3	55,3
4	55.3
5	54.5
6	54.5
7	54.5
8	54.5
9	54.5
10	54.5
11	53.6
12	53.6
13	52.8
14	52.8
15	52.8
16	52.8
17	52.8
18	53.6
19	54.5
20	55.3
21	55.3
22	53.6
23	55.3
24	52.8
25	52.8
26	53.6
27	54.5
28	53.6
29	53.6
30	53.6
31	54.5
32	53.6
33	53.6
34	51.8
35	52.8
36	52.8
37	52.8
38	52.8
39	52.8
40	52.8

Turbine	GCF (%)
41	52.8
42	53.6
43	54.6
44	53.6
45	52.8
46	54.5
47	53.6
48	52.8
49	52.8
50	51.8
51	52.8
52	51.8
53	52.8
54	52.8
55	52.8
56	52.8
57	52.8
58	52.8
59	52.8
60	51.8
61	52.8
62	52.8
63	52.8
64	52.8
65	52.8
66	52.8
67	52.8
68	51.8
69	52.8
70	53.6
71	53.6
72	51.8
73	52.8
74	52.8
75	52.8
76	52.8
77	52.8
78	52.8
79	51.8
80	52.8

Turbine	GCF (%)
81	52.8
82	52.8
83	52.8
84	52.8
85	52.8
86	52.8
87	52.8
88	52.8
89	52.8
90	51.8
91	51.8
92	52.8
93	51.8
94	50.8
95	50.8
96	50.8
97	49.7
98	52.8
99	50.8
100	54.5
101	54.5
102	54.5
103	54.5
104	50.8
105	51.8
106	53.6
107	52.8
108	50.8
109	51.8
110	51.8
111	50.8
112	51.8
113	51.8
114	51.8
115	51.8
116	51.8
117	50.8
118	50.8
Overall	52.92

6. NET ENERGY PROJECTIONS

To convert gross to net output projections, one must first evaluate the individual discount factors involved. The following list of discount factors provides a comprehensive summary of what we consider to be the key power losses in converting from potential gross turbine output to realized net project output:

- Turbine availability, 4%: This assumes typical O&M downtime and other standard availability history for GE turbines, incorporating the fact that this is new turbine model with no operating experience. First-year availability is usually 2% less than the availability for mature projects. When we receive the contractual terms from GE for Mesquite Creek, we will amend this value as appropriate.

- Electrical losses, 2.5%: This is a typical industry value, and will be modified as appropriate when specific losses are supplied by an electrical engineer for Mesquite Creek.

- Wake losses, 6.2%. This is calculated using the V-Bar wake model. There are no existing or planned wind farms within 20 km of Mesquite Creek, and thus no external wake losses.

- Turbine performance, 3.07%, including turbulence (1%, standard value), high-wind hysteresis (0.1%, based on the annual wind speed frequency distribution and control algorithms near cut-out speed), sub-optimal operations (1%, accounting for control software settings, hardware performance, O&M efficiency, etc.), and power curve inaccuracy (1%, per presentations at the AWEA 2012 wind resource assessment workshop). The combined discount of 3.07% is obtained by multiplying the efficiencies of the individual discount factors (0.99 x 0.999 x 0.99 x 0.99).

- Environmental factors, 1.93%, including blade degradation and soiling (1%, standard value), icing (0.5%, based on an average 61.4 hours/year with anemometer icing at Site 6341 and an assumed loss of 2/3 the energy during those house), high/low temperature shutdowns (0.15%, based on the standard operating range of -15C to +40C for GE turbines of this class, see Table 12), lightning (0.2%, based on 4-5 lightning strikes/km² per year), and site access/force majeure (0.1%). No discount is applied for tree growth, as there are very few trees. The combined discount of 1.93% is obtained by multiplying the efficiencies of the individual discount factors.

- Curtailment, 0%. This assumes GE will certify the Mesquite Creek array with no requirement for wind direction sector management, and there is no unreimbursed curtailment by the off-taker, nor any other cause for curtailment.

- Balance of plant, 1%, which is a typical industry value for non-turbine related plant downtime.

The combined discount is obtained from the product of the individual efficiencies, as the above discount factors are considered independent of each other. For Mesquite Creek, this combined discount is 17.38%.

Here are the resulting long-term mean annual net energy projections for Mesquite Creek, reducing the gross 52.92% capacity factor projection by the 17.38% total discount factor:

- 43.73% net capacity factor
- 6,856 MWh/turbine
- 809,045 MWh for the entire array

First-year projections would nominally be 2% less than the above values, to allow for startup procedures and maturing the turbines.

Table 12. Joint Frequency Distribution of 80-m Wind Speed and 2-m Temperature*
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation
of America
Using Wind Speed and Temperature Data from Site 6341
July 2009-June 2013

Hours of Joint Occurrence

Speed (mps)	Temperature (°C)… < -15	-15 to -10	-10 to 0	0 to 10	10 to 20	20 to 30	30 to 35	35 to 40	> 40	Total Hours
0	0	0	2	15	8	4	0	0	0	29
1	0	0	16	88	102	68	11	2	0	287
2	0	0	34	202	242	237	89	4	0	808
3	0	0	62	361	427	522	177	50	0	1599
4	0	0	77	511	638	845	234	125	0	2430
5	0	1	139	588	796	1079	381	185	5	3174
6	0	11	140	650	1008	1281	484	188	3	3765
7	0	7	134	653	1056	1340	571	214	4	3979
8	1	7	106	595	1010	1341	473	170	4	3707
9	5	5	91	513	989	1332	421	106	6	3468
10	1	2	59	445	771	1111	337	62	3	2791
11	0	3	26	357	677	975	273	48	6	2365
12	0	9	37	262	562	780	193	24	2	1869
13	0	9	27	254	539	567	134	11	2	1543
14	0	5	26	163	498	460	81	9	0	1242
15	0	2	16	121	357	245	47	7	0	795
16	0	2	7	98	236	151	23	3	0	520
17	0	0	6	55	159	63	13	1	0	297
18	0	1	4	31	81	35	8	1	0	161
19	0	2	1	17	36	10	2	0	0	68
20	0	1	2	9	18	1	2	0	0	33
21	0	0	0	2	13	3	3	0	0	21
22	0	0	0	4	4	2	0	0	0	10
23	0	0	0	2	3	1	0	0	0	6
24	0	0	0	1	0	0	0	0	0	1
25	0	0	0	0	1	0	0	0	0	1
26+	0	0	0	0	0	0	0	0	0	0
Total	7	67	1012	5997	10231	12453	3957	1210	35	34969
Mean Speed	9.0	10.6	7.3	7.9	8.7	8.3	7.9	7.0	8.7	8.2
Percent Time	0.0	0.2	2.9	17.1	29.3	35.6	11.3	3.5	0.1	100.0
GE-1.79/100 Energy…										
MWh	10	88	788	5398	10744	12718	3711	878	40	34375
Percent	0.03	0.25	2.29	15.70	31.26	37.00	10.80	2.55	0.12	100.00

** standard operating temperature range for the GE-1.79/100 turbine is -15°C to +40°C*

7. WIND DIRECTION PATTERNS

Wind direction patterns at Mesquite Creek are determined by the general southerly winds crossing Texas during the warmer months, and frequent northerly winds in winter.

Figure 3 shows the multi-year wind power rose for Site 6341, in particular the annual percentage of GE-1.79/100 energy by 10-degree wind direction sectors. Table 13 presents this information in tabular format. Wind direction patterns for the other Mesquite Creek meteorological towers are virtually identical, so the data from Site 6341 fully reflect the entire turbine array.

65% of the annual wind energy potential comes from the wind direction sector southeast through west.

Table 14 shows the so-called off-axis wake losses in annual energy between two turbines as a function of their azimuth orientation and spacing. (Such losses are also referred to as “in-line” or “column wind” wakes). This table combines virtually identical data computed individually for Sites 6341, 2052 and 2163. These data have been incorporated into the wake loss calculations.

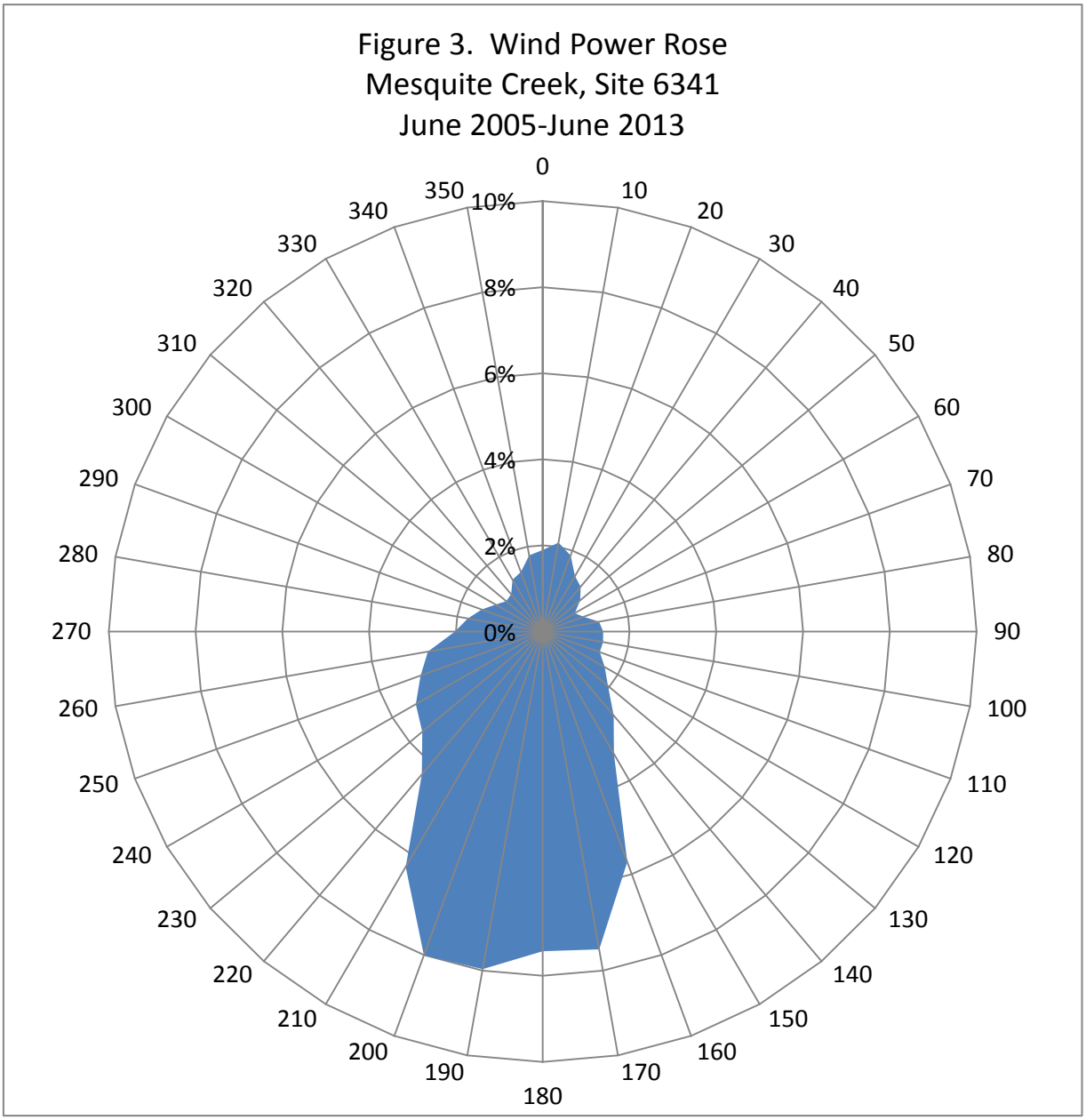
Figure 3. Wind Power Rose
Mesquite Creek, Site 6341
June 2005-June 2013
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
10%
8%
6%
4%
2%
0%

Table 13. Wind Rose, Site 6341, 80-m Level
Mesquite Creek, Texas
Data from June 2005-June 2013

Number of Hours

	Wind Speed (mps)…											GE-1.79/100 Energy	
Direction	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-25	26+	Row Total	Mean Speed	kWh	Percent
0	58	206	306	276	116	44	16	0	0	1022	8.6	1,081,252	1.89
10	88	260	404	323	118	25	1	1	0	1220	8.0	1,197,359	2.10
20	75	280	438	275	84	17	2	0	0	1171	7.7	1,073,398	1.88
30	83	378	413	198	55	5	0	0	0	1132	6.9	848,790	1.49
40	115	435	434	167	37	4	0	0	0	1192	6.4	776,110	1.36
50	126	609	432	103	25	1	0	0	0	1295	5.9	643,481	1.13
60	142	511	365	69	7	2	0	0	0	1095	5.6	487,179	0.85
70	142	622	447	75	8	0	0	0	0	1293	5.6	571,249	1.00
80	131	555	515	141	10	2	0	0	0	1353	6.0	752,522	1.32
90	136	604	576	136	11	0	0	0	0	1463	6.0	795,046	1.39
100	155	684	568	141	11	1	0	0	0	1559	5.9	806,049	1.41
110	145	680	531	158	7	1	1	0	0	1523	5.9	798,743	1.40
120	137	722	646	179	8	3	1	0	0	1695	6.1	941,635	1.65
130	130	632	772	220	10	3	0	0	0	1768	6.4	1,119,944	1.96
140	84	627	919	329	19	7	0	0	0	1984	6.9	1,451,722	2.54
150	81	650	974	480	73	7	0	0	0	2264	7.3	1,872,827	3.28
160	97	601	1260	912	251	26	2	0	0	3148	8.2	3,251,949	5.70
170	88	647	1388	1228	415	49	3	0	0	3818	8.6	4,280,281	7.50
180	85	608	1208	1103	569	94	3	0	0	3670	8.9	4,240,208	7.43
190	82	602	1088	1037	759	195	8	1	0	3772	9.4	4,546,358	7.96
200	86	540	968	931	831	297	12	0	0	3665	9.8	4,570,165	8.01
210	113	478	705	805	591	246	16	0	0	2955	9.6	3,604,849	6.32
220	118	358	487	623	357	143	12	0	0	2097	9.2	2,473,624	4.33
230	85	275	440	455	326	140	9	1	0	1730	9.5	2,068,783	3.62
240	97	236	356	389	306	168	32	2	0	1585	9.8	1,927,745	3.38
250	74	195	305	316	254	170	57	7	0	1377	10.2	1,710,007	3.00
260	60	195	258	254	255	164	45	7	1	1238	10.3	1,533,688	2.69
270	53	153	225	207	183	108	30	7	1	966	10.0	1,154,507	2.02
280	47	146	227	162	141	106	30	10	1	869	9.9	1,000,057	1.75
290	46	137	168	137	143	97	14	1	0	741	9.7	853,668	1.50
300	58	146	136	124	124	66	15	0	0	669	9.1	715,033	1.25
310	38	114	125	134	96	44	9	4	0	565	9.2	626,560	1.10
320	44	127	147	139	106	31	6	4	0	603	8.9	646,172	1.13
330	48	129	166	199	128	26	5	1	0	701	8.9	793,818	1.39
340	64	142	223	205	119	28	3	0	0	785	8.5	840,773	1.47
350	50	206	261	233	140	40	7	0	0	956	8.7	1,025,991	1.80
Calms	5									5			
Totals	3263	14493	18877	12882	6690	2357	335	43	3	58944	8.2	57,081,533	100.00

83.8% Data Recovery

Table 14. Off-Axis Wake Losses (%)
Mesquite Creek, Texas, Sites 6341, 2052 and 2163
BNB Renewable Energy LLC/Sumitomo Corporation of America
Turbine: GE-1.79/100

Row Orientation	Spacing (Rotor Diameters)… 1.5 RD	2.0 RD	2.5 RD	3.0 RD	3.5 RD	4.0 RD
360/180	27.46	17.41	12.03	9.03	7.03	5.75
010/190	27.94	17.74	12.28	9.23	7.20	5.89
020/200	26.48	16.60	11.45	8.64	6.76	5.55
030/210	23.58	14.46	9.81	7.33	5.68	4.63
040/220	20.22	12.03	7.95	5.84	4.46	3.60
050/230	17.15	9.98	6.52	4.80	3.67	2.96
060/240	14.76	8.68	5.75	4.26	3.28	2.66
070/250	13.13	7.89	5.30	3.95	3.06	2.49
080/260	11.97	7.26	4.90	3.66	2.83	2.31
090/270	11.01	6.64	4.47	3.33	2.57	2.09
100/280	10.25	6.10	4.06	3.00	2.31	1.88
110/290	9.89	5.78	3.81	2.81	2.16	1.75
120/300	10.16	5.86	3.84	2.83	2.16	1.75
130/310	11.47	6.52	4.23	3.12	2.38	1.93
140/320	13.96	7.99	5.16	3.78	2.87	2.31
150/330	17.42	10.31	6.80	4.99	3.81	3.07
160/340	21.41	13.08	8.87	6.62	5.14	4.19
170/350	25.09	15.68	10.78	8.12	6.34	5.20

8. TURBULENCE

Turbulence intensity statistics have been calculated for the top monitoring level of the five currently operating Mesquite Creek meteorological towers. (Site 6341 uses its 76-m data). Complete summary statistics are presented in Appendix E for individual towers.

Mean turbulence intensities are generally less than 0.10 in winds greater than 7 mps.

Characteristic turbulence is defined as the mean turbulence intensity plus one standard deviation in a 15-mps wind. For the 76-m level of Site 6341, its characteristic turbulence is 0.091. Characteristic turbulence at the other met towers is 0.10-0.12 at their measurement levels, and should be a maximum of 0.11 at hub height.

9. EXTREME WINDS

Monthly 2-second peak gusts at the Mesquite Creek meteorological towers are given in Appendix F for all measurement levels. The extreme recorded gust has been 44 mps.

Although not shown in this report, the maximum observed hourly mean wind speed was 28.8 mps.

There are sufficient on-site data from Site 6341 to justify the use of the Gumbel distribution method for estimating the 50-year return 10-minute mean wind speed (called Vref) and the 50-year return 3-second gust at hub height. The results are:

- Vref 35.8 mps
- Gust 49.1 mps

10. CONFIDENCE LIMITS IN ENERGY PROJECTIONS

The discussion below addresses the confidence limits in long-term energy projections for Mesquite Creek. We first identify the factors that contribute to project wind output uncertainty in estimating the aggregate long-term mean annual hub-height wind speed. These factors are based on both quantitative and qualitative analysis. They are listed below as 95% confidence limits and then explained in detail:

- Uncertainty in long-term mean annual wind speeds at reference stations: ±1.69%
- Correlation between reference stations and Site 2701: ±1.93%
- Correlation between Site 6341 and the other Mesquite Creek met towers: ±0.74%
- Shear uncertainties to 80 m: ±0.81%
- Micrositing uncertainty: ±6.0%
- Anemometer accuracy, including mounting: ±4.5%
- Long-term climate change: ±3.5%
- ASOS station exposures and cup/sonic mean speed conversion: ±3.0%

(1) Uncertainty in long-term mean annual wind speed at reference stations Abilene, Lubbock and Midland. This factor represents the potential error in assuming that the observed wind speeds at the reference stations are accurate representations of the long-term winds. We computed the standard deviations of the average 17.33 years of (sonic-equivalent) annual mean speeds at both stations, which averaged 3.58% of their overall means. This is equivalent to a 0.86% standard error of estimate in the population mean. The 95% confidence limits are 1.96 times the standard error of estimate, or ±1.69%.

(2) Correlations of the reference stations to Site 6341. This factor represents the potential error in estimating long-term wind speeds at Site 6341 based on the reference stations. We computed the monthly mean wind speed ratios of the 76-m level of Site 6341 to the combined average speeds at the reference stations. The standard deviation of these ratios is 9.27% of the mean ratio, for an 89-month data set. This is equivalent to a 0.98% standard error of estimate in the population mean and 95% confidence limits of ±1.93%.

(3) Correlations between Site 6341 and the other Mesquite Creek met towers. This factor represents the potential error in estimating long-term wind speeds at the other Mesquite Creek met towers based on the primary tower Site 6341. Individual 50-m or 60-m speed ratios of the four pertinent sites (2052, 2163, 2164, 2165) were computed, and they averaged 2.13% when weighted by period of record. This is equivalent to 95% confidence limits of ±0.74%.

(4) Shear uncertainties to 80 m. This factor represents the potential error in using shear adjustments to estimate hub-height wind speeds based on anemometer-level wind speeds. The average shear exponent at the five Mesquite Creek met towers is 0.22. We have assumed the minimum shear in extrapolating to 80 m is 0.19, which reflects the fact that we have both hub-height anemometer measurements at Site 6341 and the sodar, plus some information extending to the top of the rotor disk, which is 130 m above ground. The average top monitoring level of the five towers (using 76 m at Site 6341) is 61 m,

and the 80/61 m speed ratios would be 1.061 with a 0.22 shear and 1.053with a 0.19 shear. The relative difference of 0.81% represents the 95% confidence limits in extrapolating winds to 80 m at the meteorological towers.

(5) Micrositing uncertainty. This uncertainty factor represents the potential for error in estimating long-term mean annual hub-height wind speeds at individual turbine locations based on the hub-height wind speeds at the met towers. This figure is based on the 8% difference between the highest and lowest predicted long-term hub height wind speeds among the various met towers, the terrain character (mostly flat, but with a number of sites near escarpment edges), the number of met towers and their representativeness of the turbine layout, and the minimal variations in surface roughness. These factors suggest a micrositing uncertainty of ±6.0%.

(6) Anemometer accuracy. NRG #40C sensors haves an inherent uncertainty of ±2%. However, the earlier stations have unverified configurations and are not well documented. There are also issues with post-calibration of many sensors which had four years in the field, plus the potential tower influences on Site 6341 due to its short booms. Taking all this into consideration, we conclude the 95% confidence limits of the accuracy of the anemometer data are ±4.5%.

(7) Long-term climate change. Many investigators incorporate a 3% or greater uncertainty for potential climate change, and we that ±3.5% is a reasonable value.

(8) The cup/sonic conversion at the ASOS stations. The range of inferred decreases in mean wind speeds with sonic anemometers was -10% to +1% for the 39 cases we evaluated in our 2008 paper. This study, plus subsequent review of this issue suggests 95% confidence limits of ±3% in the uncertainty of the conversion of historical cup anemometer data to sonic-equivalent mean speeds.

The root-sum-square of these factors is 9.23%. This means the long-term mean annual aggregate hub-height wind speed projection of 8.02 mps has 95% confidence limits of 7.28 and 8.76 mps.

These wind speed values translate into a lower 95% confident limit in gross energy projections of 14.08% below the mean and an upper 95% confidence limit of 11.91% above the mean.

To convert the uncertainty in gross production to that of net projection, one must incorporate miscellaneous factors such as the shape of the annual wind speed frequency distribution and the accuracy of the discount factors used to convert gross to net projections. Table 15 lists the upper and lower 95% confidence limits assigned to each of the eight identified factors. Their combined 95% confidence limits are -6.44% and +5.45%, obtained using the same root-mean-square method used above.

Note these uncertainty analyses explicitly assume that the GE-1.79/100 turbine performs according to the power curve given in Table 2.

Table 15. 95% Confidence Limits in Gross-to-Net Energy Projections

Factor	Lower Limit (%)	Upper Limit (%)	Remarks
Wind speed frequency distribution	-3	+3	Long years of record at some location, much of project has limited on-site data
Turbine availability	-2	+1½	Based on general knowledge of GE turbine
Electrical losses	-1	+1	Typical uncertainty pending formal calculations
Wake losses	-3½	+3½	Based on wind flow characteristic and array shape
Turbine performance	-2½	+1	Allowing for individual uncertainties
Environmental factors	-2	+2	Based on experience in the region
Curtailment	-2	+0	Allowing for possible off-taker curtailment
Balance of plant	-1	+½	Typical range for this category
COMBINED*	-6.44	+5.45	Obtained by root-sum-square method

The incorporation of these miscellaneous factors (done on a root-sum-square basis) results in the following 95% confidence limits in long-term mean annual net energy projections for Mesquite Creek (Table 16):

Table 16. 95% Confidence Limits in Long-Term Mean Annual Net Energy Projections

Case	Energy Deviation from P50 (%)	Energy Deviation from P50 (MWh/year)	Resulting Energy Output (MWh/year)
P50	0	0	809,045
Lower 95% confidence	-15.48	-125,267	683,778
Upper 95% confidence	+13.10	+106,015	915,060

Using the standard statistical technique known as error function theory, we have calculated the equivalent probability of exceedance values for the Mesquite Creek project in Table 17. Ten-year and one-year probabilities are given in this table.

These probability distributions incorporate an additional uncertainty factor representing interannual wind energy fluctuations. The 3.58% standard deviation of interannual mean wind speeds at the reference stations is equivalent to a gross energy standard deviation of 5.4%, based on interpolation from Tables 10 and 11. We increased this standard deviation to 8.1% to incorporate annual uncertainties in the shape of the annual wind speed frequency distribution and loss factors for converting gross to net projections.

The energy production data in Table 17 are rounded to the nearest 100 MWh/year, except for the P50 values.

Table 17. Ten-Year and One-Year Energy Probability of Exceedance Levels, Mesquite Creek, Texas

P-Value	Ten-Year NCF (%)	Ten-Year MWh	One-Year NCF (%)	One-Year MWh
P99	35.30	653,200	32.24	596,500
P95	37.74	698,200	35.56	657,900
P90	39.08	723,100	37.39	691,800
P75	41.26	763,400	40.36	746,800
P50	43.73	809,045	43.73	809,045
P25	45.85	848,400	46.85	866,900
P10	47.73	883,100	49.61	917,900

11. TIME-OF-DAY ENERGY PRODUCTION

Hourly 76-m wind speed data files from Site 6341 have been adjusted to reflect the aggregate mean hub-height wind speed of Mesquite Creek. These data were then combined with the GE-1.79/100 power curve to simulate energy output for every hour from June 2005 through November 2013.

These data were then summarized in Table 18 into so-called "12x24" or monthly/diurnal means. For presentation purposes, data are expressed as mean monthly/diurnal net capacity factors.

Table 18. Simulated Long-Term Monthly/Diurnal Mean Net Capacity Factor (%)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America
Based on Data from Site 6341, June 2005-November 2013
Turbine: GE-1.79/100, 80-m Hub Height

Hour (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	60.0	54.1	61.9	65.0	56.6	56.6	41.4	47.0	43.9	53.9	59.2	58.1
1	61.6	53.9	59.0	60.8	53.0	56.1	38.3	47.3	44.0	53.0	58.4	58.1
2	59.7	53.0	58.6	59.0	54.8	50.4	38.9	46.9	42.0	50.8	57.4	57.4
3	59.0	53.1	57.4	58.2	49.8	47.4	39.6	44.3	38.4	48.5	54.5	54.9
4	59.7	53.8	57.5	56.9	47.0	45.2	38.4	42.7	36.5	47.8	53.9	55.3
5	59.9	52.8	57.1	56.9	47.7	43.3	34.3	38.1	34.7	46.3	53.4	55.7
6	59.1	54.5	55.9	55.3	46.1	39.1	28.1	34.2	32.5	43.6	53.8	55.4
7	57.9	54.7	53.7	51.9	43.2	38.6	24.7	28.0	25.0	40.4	52.2	53.8
8	56.5	52.9	49.1	51.0	41.1	42.4	24.6	25.8	22.8	34.6	47.7	53.7
9	48.4	46.0	45.0	49.4	37.9	38.5	22.2	23.2	22.9	31.3	39.9	45.7
10	40.0	41.1	43.3	46.5	34.9	34.1	17.1	19.2	21.1	29.7	35.6	37.4
11	38.2	39.0	42.8	44.3	33.5	30.0	15.1	17.5	19.9	28.7	33.9	34.6
12	38.5	41.5	41.5	43.6	32.8	27.1	15.1	16.8	18.6	29.0	33.6	34.5
13	38.9	43.5	42.7	44.9	34.8	27.2	15.2	17.0	18.1	29.2	34.3	35.2
14	38.4	43.9	43.6	46.6	36.9	28.3	17.0	16.1	18.1	31.3	35.3	35.7
15	37.5	43.9	44.8	48.5	39.7	32.1	18.5	17.0	18.1	32.2	36.1	35.4
16	37.1	42.7	46.5	51.4	42.7	34.4	20.8	19.3	20.7	33.9	36.4	34.7
17	37.6	41.1	48.5	52.9	44.7	37.7	24.2	21.0	22.6	34.5	37.2	36.3
18	43.1	42.0	49.1	55.2	45.6	41.8	27.2	23.4	25.2	38.9	47.7	44.7
19	49.3	47.7	52.9	58.7	47.2	47.3	30.2	28.8	32.7	47.3	56.1	50.8
20	52.2	52.4	60.3	64.6	56.0	55.9	34.8	37.4	40.0	53.5	59.0	52.8
21	54.5	55.4	63.3	66.8	59.4	59.4	41.7	43.3	44.2	56.2	61.2	54.0
22	56.4	55.3	62.9	68.1	59.5	60.1	43.4	47.4	47.0	57.4	63.7	56.3
23	58.0	55.7	62.8	68.5	57.5	60.2	42.8	48.9	45.5	54.9	62.8	57.4
Month	50.1	48.9	52.5	55.2	45.9	43.1	28.9	31.3	30.6	41.9	48.5	47.8

Year: 43.73

APPENDIX A

Documentation of Mesquite Creek Meteorological Towers

Time Zone: Central Standard Time
Magnetic Declination: 7° East (true north = 353° magnetic)

All NRG #40C anemometers use NREL default calibration constants (slope 0.765 mps/Hz; offset 0.35 mps) in analyzing and presenting the data.

SITE 6341
Installed: 21 April 2005 (first data 22 June 2005)
Logger Type/Serial Number: NRG Symphonie/06341
Tower Height: 137 m
Tower Diameter: 36" (triangular lattice)
Closest Town: Lamesa, TX
WGS84 Coordinates: 32° 44.592'N latitude, 101° 43.654'W longitude
Elevation: 888 m ASL
Site Exposure: communications tower on finger ridge of Caprock escarpment protruding into lower ground

Sensors:

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants		
							Slope	Offset	Units
Anemometer	NRG #40	N/A	1	75.6	60.5	232°	0.765	0.35	mps
Anemometer	NRG #40	N/A	2	75.6	60.5	052°	0.765	0.35	mps
Anemometer	NRG #40	N/A	3	56.4	60.5	232°	0.765	0.35	mps
Anemometer	NRG #40	N/A	4	56.4	60.5	052°	0.765	0.35	mps
Anemometer	NRG #40	N/A	5	38.0	60.5	232°	0.765	0.35	mps
Anemometer	NRG #40	N/A	6	38.0	60.5	052°	0.765	0.35	mps
Wind Vane	NRG 200P	N/A	7	74.0	60.5	232°	0.351	0	degrees
Wind Vane	NRG 200P	N/A	8	36.6	60.5	232°	0.351	0	degrees
Thermometer	NRG 110S	N/A	9	N/A	N/A	N/A	0.136	-86.38	°C

SITE 6341 RECONFIGURED 22 JUNE 2009…

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (“)	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40C	110050	1	119.9	74	232°	0.758	0.37	mps
Anemometer	NRG #40C	111145	2	118.0	180	232°	0.760	0.34	mps
Anemometer	NRG #40C	111146	3	76.2	74	232°	0.760	0.34	mps
Anemometer	NRG #40C	111147	4	56.0	74	232°	0.755	0.34	mps
Anemometer	NRG #40C	111148	5	38.1	74	232°	0.756	0.36	mps
Anemometer	NRG #40C	101186	6	14.9	74	232°	0.757	0.37	mps
Wind Vane	NRG 200P	N/A	7	74.5	74	232°	0.351	52	degrees
Wind Vane	NRG 200P	N/A	8	36.6	74	232°	0.351	52	degrees
Thermometer	NRG 110S	N/A	9	74.8	N/A	360°	0.136	-86.38	°C
Thermometer	NRG 110S	N/A	10	2	N/A	360°	0.136	-86.38	°C

SITE 6341, NEW ANEMOMETERS AND WIND VANES, 14 FEBRUARY 2013…

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40C	212097	1	119.9	74	232°	0.763	0.39	mps
Anemometer	NRG #40C	212126	2	118.0	180	232°	0.771	0.36	mps
Anemometer	NRG #40C	212141	3	76.2	74	232°	0.771	0.36	mps
Anemometer	NRG #40C	212142	4	56.0	74	232°	0.774	0.35	mps
Anemometer	NRG #40C	212140	5	38.1	74	232°	0.768	0.38	mps
Anemometer	NRG #40C	212129	6	14.9	74	232°	0.772	0.35	mps
Wind Vane	NRG 200P	N/A	7	74.5	74	232°	0.351	52	degrees
Wind Vane	NRG 200P	N/A	8	36.6	74	232°	0.351	52	degrees
Thermometer	NRG 110S	N/A	9	74.8	N/A	360°	0.136	-86.38	°C
Thermometer	NRG 110S	N/A	10	2	N/A	360°	0.136	-86.38	°C

SITE 2031
Installed: 3 May 2006
Logger Type/Serial Number: NRG Symphonie/08964
Tower Height: 60 m
Tower Diameter: N/A
Closest Town: Lamesa, TX
WGS84 Coordinates: 32° 44.312'N latitude, 101° 44.946'W longitude
Elevation: 893 m ASL
Site Exposure: open flat field, no significant vegetation, one-story home and outbuildings to the northeast

Sensors:

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants** Slope	Offset	Units
Anemometer	NRG #40	N/A	1	59.5	N/A	095°	0.765	0.35	mps
Anemometer	NRG #40	N/A	2	59.5	N/A	265°	0.765	0.35	mps
Anemometer	NRG #40	N/A	3	40	N/A	N/A	0.765	0.35	mps
Anemometer	NRG #40	N/A	4	20	N/A	N/A	0.765	0.35	mps
Wind Vane	NRG 200P	N/A	7	57.5	N/A	N/A	0.351	0	degrees
Wind Vane	NRG 200P	N/A	8	18	N/A	N/A	0.351	0	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	N/A	0.136	-86.38	°C
Barometer	NRG BP20	N/A	10	3	N/A	N/A	0.4255	650	mb

SITE 2029
Installed: 2 May 2006 (first data 18 June 2006)
Logger Type/Serial Number: NRG Symphonie/08966
Tower Height: 60 m
Tower Diameter: N/A
Closest Town: Lamesa, TX
WGS84 Coordinates: 32° 42.131'N latitude, 101° 42.569'W longitude
Elevation: 878 m ASL
Site Exposure: open flat agricultural field, 700 m south of caprock escarpment

Sensors:

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40	N/A	1	59.5	N/A	100°	0.765	0.35	mps
Anemometer	NRG #40	N/A	2	59.5	N/A	270°	0.765	0.35	mps
Anemometer	NRG #40	N/A	3	40	N/A	N/A	0.765	0.35	mps
Anemometer	NRG #40	N/A	4	20	N/A	N/A	0.765	0.35	mps
Wind Vane	NRG 200P	N/A	7	57.5	N/A	N/A	0.351	0	degrees
Wind Vane	NRG 200P	N/A	8	18	N/A	N/A	0.351	0	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	N/A	0.136	-86.38	°C

SITE 2052
Installed: 1 November 2006
Logger Type/Serial Number: NRG Symphonie/10234
Tower Height: 60 m
Tower Diameter: N/A
Closest Town: Lamesa, TX
WGS84 Coordinates: 32° 45.827'N latitude, 101° 44.824'W longitude
Elevation: 888 m ASL
Site Exposure: open flat agricultural field, 100 m south of caprock escarpment

Sensors:

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40	N/A	1	58	N/A	095°	0.765	0.35	mps
Anemometer	NRG #40	N/A	2	58	N/A	265°	0.765	0.35	mps
Anemometer	NRG #40	N/A	3	40	N/A	N/A	0.765	0.35	mps
Anemometer	NRG #40	N/A	4	20	N/A	N/A	0.765	0.35	mps
Wind Vane	NRG 200P	N/A	7	56	N/A	N/A	0.351	0	degrees
Wind Vane	NRG 200P	N/A	8	18	N/A	N/A	0.351	0	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	N/A	0.136	-86.38	°C
Barometer	NRG BP20	N/A	10	3	N/A	N/A	0.4255	650	mb

SITE 2052 RECONFIGURED 10 JULY 2009…

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40C	112277	1	49.6	60.5	270°	0.761	0.33	mps
Anemometer	NRG #40C	112278	2	49.6	60.5	137°	0.756	0.34	mps
Anemometer	NRG #40C	112279	3	30.0	60.5	268°	0.758	0.36	mps
Anemometer	NRG #40C	112280	4	30.0	60.5	137°	0.762	0.34	mps
Anemometer	NRG #40C	112282	5	10.0	60.5	268°	0.759	0.35	mps
Anemometer	NRG #40C	112283	6	10.0	60.5	137°	0.761	0.35	mps
Wind Vane	NRG 200P	N/A	7	47.5	60.5	224°	0.351	44	degrees
Wind Vane	NRG 200P	N/A	8	27.4	60.5	225°	0.351	45	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	360°	0.136	-86.38	°C
Barometer	NRG BP20	180587608	10	1.5	N/A	360°	0.4255	650	mb
Hygrometer	NRG RH5	N/A	11	1.5	N/A	180°	0.097	0	%

SITE 2052, NEW SENSORS 14 FEBRUARY 2013…

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40C	212144	1	49.6	60.5	265°	0.771	0.37	mps
Anemometer	NRG #40C	212114	2	49.6	60.5	133°	0.770	0.36	mps
Anemometer	NRG #40C	212098	3	30.0	60.5	265°	0.769	0.34	mps
Anemometer	NRG #40C	212143	4	30.0	60.5	133°	0.770	0.37	mps
Anemometer	NRG #40C	212145	5	10.0	60.5	265°	0.769	0.37	mps
Anemometer	NRG #40C	212113	6	10.0	60.5	137°	0.773	0.34	mps
Wind Vane	NRG 200P	N/A	7	47.5	60.5	222°	0.351	44	degrees
Wind Vane	NRG 200P	N/A	8	27.4	60.5	223°	0.351	45	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	360°	0.136	-86.38	°C
Barometer	NRG BP20	1.81E+08	10	1.5	N/A	360°	0.4255	652.51	mb
Hygrometer	NRG RH5	N/A	11	1.5	N/A	180°	0.097	0	%

SITE 2163
Installed: 8 November 2009
Logger Type/Serial Number: NRG Symphonie/12426
Tower Height: 50 m
Tower Diameter: 6 inches
Closest Town: Lamesa, TX
WGS84 Coordinates: 32° 41.413'N latitude, 101° 45.767'W longitude
Elevation: 887 m ASL
Site Exposure: open flat agricultural field, no significant vegetation or obstructions

Sensors:

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40C	123889	1	49.6	60.5	271°	0.760	0.35	mps
Anemometer	NRG #40C	120496	2	49.6	60.5	137°	0.758	0.35	mps
Anemometer	NRG #40C	126650	3	30.0	60.5	271°	0.757	0.41	mps
Anemometer	NRG #40C	126561	4	30.0	60.5	136°	0.760	0.34	mps
Anemometer	NRG #40C	126562	5	10.0	60.5	271°	0.759	0.35	mps
Anemometer	NRG #40C	126563	6	10.0	60.5	136°	0.758	0.40	mps
Wind Vane	NRG 200P	N/A	7	47.5	60.5	225°	0.351	45	degrees
Wind Vane	NRG 200P	N/A	8	27.4	60.5	225°	0.351	45	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	360°	0.136	-86.38	°C

SITE 2163, NEW SENSORS 13 FEBRUARY 2013…

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40C	212130	1	49.6	60.5	267°	0.773	0.36	mps
Anemometer	NRG #40C	212127	2	49.6	60.5	135°	0.772	0.39	mps
Anemometer	NRG #40C	212133	3	30.0	60.5	267°	0.772	0.35	mps
Anemometer	NRG #40C	212135	4	30.0	60.5	135°	0.773	0.38	mps
Anemometer	NRG #40C	212128	5	10.0	60.5	267°	0.773	0.34	mps
Anemometer	NRG #40C	212132	6	10.0	60.5	135°	0.771	0.37	mps
Wind Vane	NRG 200P	N/A	7	47.5	60.5	220°	0.351	45	degrees
Wind Vane	NRG 200P	N/A	8	27.4	60.5	221°	0.351	45	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	360°	0.136	-86.38	°C

SITE 2164
Installed: 6 March 2013
Logger Type/Serial Number: NRG SymphoniePLUS/04011
Tower Height: 60 m
Tower Diameter: 10 inches to 30 m, 8 inches above
Closest Town: Lamesa, TX
WGS84 Coordinates: 32° 43.941'N latitude, 101° 46.677'W longitude
Elevation: 896 m ASL
Site Exposure: open flat agricultural field, one-story farm buildings 300 m west-southwest

Sensors:

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants Slope	Offset	Units
Anemometer	NRG #40C	211988	1	59.2	95	266°	0.768	0.37	mps
Anemometer	NRG #40C	211989	2	59.2	95	132°	0.762	0.41	mps
Anemometer	NRG #40C	211990	3	50	95	266°	0.760	0.38	mps
Anemometer	NRG #40C	211991	13	32	95	266°	0.770	0.35	mps
Anemometer	NRG #40C	211992	14	32	95	132°	0.765	0.34	mps
Anemometer	NRG #40C	211993	15	10	95	266°	0.765	0.38	mps
Wind Vane	NRG 200P	N/A	7	57.2	95	266°	0.351	86	degrees
Wind Vane	NRG 200P	N/A	8	48	95	266°	0.351	86	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	360°	0.136	-86.38	°C
Thermometer	NRG 110S	N/A	10	56	N/A	360°	0.136	-86.38	°C
Pyranometer	LI200SZ	PY80320	11	2.5	N/A	360°	1.243	0	W/m²

SITE 2165
Installed: 20 August 2013
Logger Type/Serial Number: NRG SymphoniePLUS/04012
Tower Height: 60 m
Tower Diameter: 10 inches to 30 m, 8 inches above
Closest Town: Lamesa, TX
WGS84 Coordinates: 32° 42.483'N latitude, 101° 42.587'W longitude
Elevation: 881 m ASL
Site Exposure: open flat field, caprock escarpment immediately north, 0.5-m tall grass within 70 m of tower, scattered 5-10 m tall trees further away

Sensors:

Sensor Type	Model	Serial Number	Channel	Sensor Ht (m)	Boom Length (")	Boom Orientation Relative to True North	Calibration Constants** Slope	Offset	Units
Anemometer	NRG #40C	211951	1	59.2	95	269°	0.768	0.37	mps
Anemometer	NRG #40C	211950	2	59.2	95	134°	0.762	0.41	mps
Anemometer	NRG #40C	211959	3	50	95	269°	0.760	0.38	mps
Anemometer	NRG #40C	211960	13	32	95	269°	0.770	0.35	mps
Anemometer	NRG #40C	211961	14	32	95	134°	0.765	0.34	mps
Anemometer	NRG #40C	211962	15	10	95	269°	0.765	0.38	mps
Wind Vane	NRG 200P	N/A	7	57.2	95	269°	0.351	89	degrees
Wind Vane	NRG 200P	N/A	8	48	95	269°	0.351	89	degrees
Thermometer	NRG 110S	N/A	9	3	N/A	360°	0.136	-86.38	°C
Thermometer	NRG 110S	N/A	10	56	N/A	360°	0.136	-86.38	°C
Barometer	NRG BP20	18057353	11	2	N/A	360°	0.4255	650	mb

APPENDIX B

Excerpts from Paper Titled "*Impacts of sonic anemometry on using ASOS stations as long-term reference sites*," authored by V-Bar, LLC, and presented at the American Wind Energy Association's Fall Wind Resource Assessment Workshop, Portland, Oregon, September 2008

Change In Annual Mean Wind Speed Ratios (Cup/Cup to Sonic/Cup)

We analyzed monthly mean speed data at ASOS reference stations which converted to sonic anemometry, and compared their concurrent composite means to a nearby "standard" or "control" anemometer. This comparison was conducted both before and after the deployment of a sonic anemometer at the given station, with percentage differences in cup/cup and sonic/cup mean annual wind speed ratios. We presumed that these differences are due to the sonic anemometer.

39 station pairs were evaluated. They represented good geographical coverage across the USA ((states were Iowa, Illinois, Kansas, Michigan, North Dakota, Nebraska, Nevada, Oklahoma, Pennsylvania, South Dakota, Texas, Washington, and Wyoming). 75% of the control anemometers were ASOS stations, 23% were mesonet or climate network stations, and 2% were private met towers operated by wind energy developers.

The average distance between the station pairs was 133 km, with a range from 1 to 489 km. The average monthly mean wind speed correlation coefficient between the station pairs was 0.86, with a range from 0.64 to 0.98.

In particular, we compared two wind speed ratios:

- the numerator being the ratio of the annualized mean wind speed at the station with a sonic anemometer divided by the annualized mean wind speed at the control anemometer for a concurrent measurement period
- the denominator being the ratio of the annualized mean wind speed at the station before it was converted to a sonic anemometer (i.e., when it still had a cup anemometer) divided by the annualized mean wind speed at the control anemometer, again for a concurrent measurement period (different, of course, from the period used in the numerator

The shortfall of the numerator/denominator ratio from unity is interpreted as the effective decrease in mean annual wind speeds of sonic anemometry from cup anemometry.

For the 39 comparison studies, we found an average 3.7% decrease in annual mean wind speeds with sonic anemometers, with a standard deviation of 3.1%.

APPENDIX C

Monthly Mean Wind Speeds (mps),
Mesquite Creek Meteorological Towers

NRG #40C anemometers use the default NREL calibration constants: slope 0.765 mps/Hz, and offset 0.35 mps.

All monthly mean wind speed values reflect the full month when there is partial data recovery. Monthly mean speeds in these situations are calculated from mean wind speed ratios to other towers having 100% data recovery or from other levels of the same tower having 100% data recovery.

Data recovery is indicated with the following color code:

- black, 90-100%
- green, 75-90%
- blue, 50-75%
- orange, 25-50%
- light purple, 10-25%
- "x" or light gray, 0-10%

Monthly mean winds are presented for Mesquite Creek and the three long-term reference stations, one table for each year.

The reference station data are labeled as "10-sonic" for years when they were still cup anemometers. These data reflect the sonic-equivalent mean speeds, with the 4% decrease applied to the original cup mean speed data.

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2005

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne						7.1	5.5	5.0	5.4	6.1	7.4	7.2	
	38-sw						7.3	5.8	5.3	5.6	6.3	7.6	7.3	
	56.4-ne						8.2	6.3	5.9	6.4	6.7	8.3	7.9	
	56.4-sw						8.2	6.2	5.8	6.4	6.9	8.4	8.0	
	75.6-ne						9.0	6.7	6.3	7.1	7.3	8.9	8.5	
	75.6-sw						8.8	6.6	6.3	7.0	7.3	9.0	8.6	
Abilene	10-sonic						5.1	4.3	3.5	4.0	3.9	4.4	4.3	
Lubbock	10-sonic						6.0	4.6	3.9	4.4	4.2	4.8	4.7	
Midland	10-sonic						5.2	4.5	3.9	4.2	4.0	4.0	4.1	

YEAR: 2006

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne	8.7	7.4	7.9	7.9	6.7	6.2	5.6	5.4	5.8	7.0	7.4	7.6	6.96
	38-sw	8.8	7.5	7.9	8.0	6.8	6.3	5.8	5.5	5.9	7.1	7.5	7.7	7.07
	56.4-ne	9.4	8.1	8.6	8.6	7.6	7.0	6.4	6.1	6.6	7.8	8.1	8.2	7.70
	56.4-sw	9.6	8.1	8.5	8.6	7.4	6.8	6.3	5.9	6.5	7.8	8.2	8.3	7.66
	75.6-ne	10.1	8.6	9.1	9.2	8.1	7.4	6.7	6.3	6.9	8.3	8.5	8.5	8.13
	75.6-sw	10.2	8.7	9.1	9.1	8.0	7.3	6.8	6.4	6.9	8.3	8.6	8.6	8.17
2031	20					6.7	6.0	5.1	4.7	5.2	5.9	6.0	6.2	
	40					7.4	6.7	5.9	5.5	6.1	7.0	7.3	7.4	
	59.5-w					7.8	7.1	6.5	6.0	6.7	7.7	8.0	8.0	
	59.5-e					7.9	7.2	6.4	6.0	6.7	7.7	8.0	7.9	
2029	20						5.6	5.1	4.6	x	x	x	x	
	40						6.5	5.9	5.4	x	x	x	x	
	59.5-w						7.0	6.5	5.9	x	x	x	x	
	59.5-e						7.0	6.4	5.9	x	x	x	x	
2052	20											6.5	6.5	
	40											7.7	7.6	
	58-w											8.3	8.1	
	58-e											8.2	8.0	
Abilene	10-sonic	5.1	4.8	5.5	5.3	5.3	4.3	4.4	3.9	4.1	4.6	4.9	4.6	4.73
Lubbock	10-sonic	5.5	5.4	6.2	6.1	5.4	5.3	4.5	4.3	4.4	4.9	5.0	4.9	5.16
Midland	10-sonic	4.6	4.3	5.1	5.3	5.2	4.6	4.5	3.7	4.1	4.3	4.2	4.1	4.50

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2007

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne	6.7	7.9	7.0	7.5	5.9	6.0	4.6	6.0	5.5	7.0	6.1	7.4	6.47
	38-sw	6.7	8.0	7.0	7.6	5.8	5.9	4.4	5.8	5.3	6.8	6.1	7.4	6.38
	56.4-ne	7.3	8.5	7.6	8.2	6.4	6.5	5.1	6.7	6.1	7.8	6.7	7.9	7.06
	56.4-sw	7.3	8.5	x	x	x	x	x	x	x	x	x	x	
	75.6-ne	7.8	9.0	7.9	8.5	6.8	7.0	5.5	7.3	6.7	8.4	7.4	x	7.57
	75.6-sw	7.7	9.1	8.1	8.7	6.8	7.0	5.5	7.2	6.7	8.5	7.5	8.8	7.63
2031	20	5.6	6.8	6.3	7.1	5.6	5.6	4.1	5.1	4.7	5.8	5.1	5.9	5.63
	40	6.5	7.8	7.2	7.8	6.2	6.2	4.7	6.0	5.6	7.0	6.3	7.3	6.55
	59.5-w	7.0	8.4	7.6	8.0	6.3	6.4	4.9	6.2	5.8	7.2	6.6	7.4	6.83
	59.5-e	7.1	8.4	7.6	8.1	6.4	6.4	5.0	6.4	6.1	7.5	6.7	7.6	6.93
2029	20	5.9	6.3	5.9	x	x	x	x	5.1	4.6	6.0	x	x	
	40	6.9	7.5	6.9	x	x	x	x	6.1	5.7	7.2	x	x	
	59.5-w	7.5	8.3	7.5	x	x	x	x	6.5	5.9	7.4	x	x	
	59.5-e	7.1	8.0	7.3	x	x	x	x	6.5	5.9	7.5	x	x	
2052	20	5.7	6.9	6.3	6.8	5.4	5.3	4.0	5.3	4.9	6.1	5.2	6.1	5.69
	40	6.6	8.0	7.3	7.9	6.2	6.2	4.7	6.2	5.8	7.1	6.2	7.2	6.60
	58-w	x	x	x	x	x	x	x	x	x	x	x	x	x
	58-e	7.2	8.5	7.7	8.4	6.7	6.7	5.3	7.0	6.5	8.0	6.9	8.0	7.22
Abilene	10-sonic	3.6	5.2	5.1	5.5	4.0	4.1	3.0	3.9	3.9	4.7	4.5	4.6	4.34
Lubbock	10-sonic	4.7	5.5	5.1	5.7	4.9	4.7	3.6	4.7	4.3	5.2	4.4	5.0	4.83
Midland	10-sonic	4.1	4.8	4.4	5.4	4.3	4.5	3.6	4.5	4.0	4.6	3.7	4.2	4.34

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2008

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne	7.7	7.9	8.9	8.1	7.7	x	x	x	x	x	x	x	
	38-sw	7.7	8.1	8.9	8.2	7.7	7.9	6.7	4.9	4.5	x	x	x	
	56.4-ne	8.3	8.5	9.6	8.8	8.3	x	x	x	x	x	x	x	
	56.4-sw	x	x	x	x	x	x	x	x	x	x	x	x	
	75.6-ne	x	x	x	x	x	x	x	x	x	x	x	x	
	75.6-sw	9.3	9.5	10.2	9.4	8.9	9.4	7.9	5.8	5.5	x	x	x	
2031	20	6.3	6.5	7.5	7.2	6.9	7.1	5.7	4.3	4.0	5.6			
	40	7.4	7.7	8.5	x	x	x	x	x	x	x			
	59.5-w	7.9	9.0	8.8	x	x	x	x	x	x	x			
	59.5-e	7.8	9.0	8.8	x	x	x	x	x	x	x			
2029	20	x	x	x	x	x	x	5.8	4.1	3.9	5.8			
	40	x	x	x	x	x	x	6.8	4.9	4.6	6.8			
	59.5-w	x	x	x	x	x	x	x	x	x	x			
	59.5-e	x	x	x	x	x	x	7.5	5.4	5.2	7.6			
2052	20	6.6	6.8	7.6	7.2	6.9	7.3	5.7	4.3	4.0	6.0	x	x	
	40	7.6	7.9	8.8	8.3	7.8	8.1	6.6	4.9	4.6	7.0	x	x	
	58-w	x	x	x	x	x	x	x	x	x	x	x	x	
	58-e	8.5	8.8	9.6	9.1	8.5	8.8	7.2	5.5	5.1	7.8	x	x	
Abilene	10-sonic	5.2	5.3	5.7	6.0	5.5	5.9	4.6	3.2	3.4				
Lubbock	10	5.7	5.6	6.7	6.4	5.8	6.3	4.7	3.9	3.6				
Midland	10	4.2	4.8	5.6	5.4	5.7	6.2	5.0	3.6	3.0				

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2009

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	x	x	x	x	x	5.0	4.4	4.9	4.5	5.6	5.3	5.0	
	38.1-sw	x	x	x	x	x	6.5	5.6	6.1	5.7	7.0	6.7	6.2	
	56-sw	x	x	x	x	x	7.0	6.2	6.8	6.3	7.5	7.3	6.7	
	76.2-sw	x	x	x	x	x	7.4	6.7	7.3	6.7	7.9	7.9	7.1	
	118-sw	x	x	x	x	x	8.1	7.3	8.2	7.5	8.7	8.7	7.8	
	119.9-sw	x	x	x	x	x	8.0	7.2	8.2	7.4	8.7	8.7	7.8	
2052	10-se	x	x	x	x	x	x	4.5	4.9	4.4	5.4	4.8	4.6	
	10-w	x	x	x	x	x	x	4.4	4.8	4.3	5.4	4.9	4.6	
	30-se	x	x	x	x	x	x	5.5	6.1	5.5	6.7	6.2	5.9	
	30-w	x	x	x	x	x	x	5.5	6.1	5.5	6.7	6.3	5.8	
	49.6-se	x	x	x	x	x	x	6.1	6.8	6.2	7.4	7.1	6.5	
	49.6-w	x	x	x	x	x	x	6.1	6.8	6.2	7.4	7.1	6.5	
2163	10-se											4.4	4.4	
	10-w											4.5	4.4	
	30-se											5.9	5.8	
	30-w											5.9	5.7	
	49.6-se											6.7	6.4	
	49.6-w											6.7	6.4	
Abilene	10						5.1	4.0	4.3	3.9	4.8	3.8	4.0	
Lubbock	10						5.0	4.4	4.6	4.1	5.1	4.4	4.2	
Midland	10						4.6	3.7	3.7	3.6	4.5	3.4	3.7	

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2010

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	5.8	5.0	7.1	6.9	5.8	5.5	4.5	4.5	4.4	4.7	6.2	6.0	5.53
	38.1-sw	7.1	6.0	8.6	8.3	7.2	6.8	5.6	5.7	5.6	6.2	7.9	7.7	6.89
	56-sw	7.7	6.6	9.2	8.9	7.8	7.5	6.2	6.4	6.3	7.0	8.6	8.5	7.56
	76.2-sw	8.2	6.9	9.7	9.4	8.2	8.0	6.6	6.8	6.7	7.5	9.2	9.0	8.03
	118-sw	8.8	7.6	10.5	10.2	9.0	8.9	7.3	7.7	7.5	8.6	10.3	9.9	8.85
	119.9-sw	8.8	7.6	10.5	10.2	9.0	8.8	7.3	7.6	7.5	8.5	10.2	9.8	8.82
2052	10-se	5.2	4.6	6.5	6.6	5.7	5.5	4.3	4.3	4.3	4.3	5.5	5.4	5.20
	10-w	5.3	4.7	6.6	6.7	5.7	5.5	4.3	4.3	4.3	4.3	5.6	5.4	5.21
	30-se	6.6	5.8	8.1	8.0	7.1	6.8	5.4	5.5	5.5	5.8	7.2	7.1	6.55
	30-w	6.6	5.7	8.2	8.1	7.1	6.8	5.5	5.5	5.5	5.7	7.2	7.1	6.58
	49.6-se	7.3	6.4	8.9	8.8	7.8	7.5	6.1	6.2	6.2	6.6	8.2	8.0	7.33
	49.6-w	7.3	6.3	8.9	8.8	7.7	7.5	6.1	6.2	6.2	6.6	8.2	8.0	7.32
2163	10-se	4.9	4.8	6.4	6.4	5.9	5.7	4.0	3.7	3.7	4.0	5.2	5.1	4.99
	10-w	4.9	4.8	6.4	6.5	5.9	5.7	4.1	3.7	3.8	4.0	5.3	5.0	5.01
	30-se	6.4	6.0	8.0	7.8	7.1	6.8	5.3	5.1	5.1	5.6	6.9	6.7	6.40
	30-w	6.4	5.9	8.1	7.9	7.1	6.8	5.3	5.1	5.1	5.5	6.9	6.6	6.38
	49.6-se	7.1	6.5	8.8	8.6	7.8	7.4	5.9	5.8	5.8	6.4	7.8	7.6	7.11
	49.6-w	7.2	6.5	8.9	8.7	7.8	7.5	6.0	5.9	5.9	6.5	7.9	7.6	7.20
Abilene	10	4.7	4.4	5.9	6.1	4.8	5.2	4.1	3.7	4.0	3.7	5.3	4.5	4.70
Lubbock	10	4.8	4.7	6.3	6.9	6.1	5.9	4.4	4.0	4.3	4.1	5.1	4.7	5.11
Midland	10	4.1	4.4	5.8	5.8	5.5	5.5	4.7	4.2	4.1	4.0	4.5	4.2	4.72

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2011

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	5.5	6.7	6.0	7.3	6.8	6.8	5.1	5.0	4.3	5.5	6.3	5.8	5.93
	38.1-sw	7.0	8.2	7.4	9.0	8.3	8.3	6.4	6.3	5.4	6.8	7.9	7.0	7.33
	56-sw	7.6	8.8	8.1	9.7	9.0	9.0	7.1	7.1	6.0	7.5	8.6	7.5	8.00
	76.2-sw	8.0	9.2	8.6	10.3	9.5	9.6	7.5	7.5	6.4	8.0	9.1	8.1	8.49
	118-sw	8.7	9.9	9.6	11.4	10.4	10.7	8.3	8.3	7.1	9.0	10.1	8.8	9.36
	119.9-sw	8.7	9.9	9.5	11.4	10.3	10.7	8.3	8.3	7.0	9.0	10.1	8.8	9.33
2052	10-se	4.9	6.0	5.7	6.9	6.5	7.0	5.1	4.9	4.1	5.3	5.8	5.2	5.61
	10-w	4.9	6.0	5.7	6.8	6.4	6.9	5.1	4.9	4.0	5.3	5.7	5.2	5.57
	30-se	6.4	7.6	7.1	8.5	8.1	8.4	6.3	6.2	5.3	6.7	7.3	6.6	7.04
	30-w	6.4	7.6	7.1	8.5	8.0	8.5	6.3	6.2	5.2	6.7	7.4	6.6	7.04
	49.6-se	7.1	8.3	8.0	9.4	8.9	9.2	7.0	7.0	5.9	7.5	8.3	7.2	7.82
	49.6-w	7.1	8.4	8.0	9.5	8.9	9.3	7.0	6.9	5.8	7.5	8.3	7.2	7.82
2163	10-se	4.7	5.9	5.7	6.7	6.3	6.7	4.7	4.4	4.2	5.2	5.4	5.2	5.43
	10-w	4.7	5.9	5.7	6.7	6.3	6.8	4.6	4.3	4.0	5.2	5.4	5.1	5.39
	30-se	6.2	7.4	7.1	8.4	7.9	8.1	5.9	5.6	5.4	6.6	7.1	6.5	6.83
	30-w	6.2	7.4	7.1	8.4	7.8	8.2	5.9	5.7	5.3	6.6	7.1	6.6	6.84
	49.6-se	7.0	8.1	7.9	9.2	8.6	8.7	6.5	6.3	5.9	7.3	8.0	7.2	7.54
	49.6-w	7.0	8.1	7.9	9.3	8.7	9.0	6.6	6.4	5.9	7.4	8.1	7.3	7.63
Abilene	10	4.0	5.3	5.5	6.2	6.2	6.5	4.5	4.1	3.5	4.8	5.2	4.3	5.01
Lubbock	10	4.5	5.6	5.4	6.7	6.4	7.0	4.7	4.4	4.0	5.0	5.3	4.8	5.33
Midland	10	3.9	4.8	5.1	6.2	5.9	6.3	4.8	4.3	4.0	4.7	4.9	4.6	4.94

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2012

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	6.7	6.4	6.6	6.1	5.8	5.8	4.9	4.6	5.0	5.5	5.7	6.5	5.80
	38.1-sw	8.5	7.7	7.9	7.5	7.0	7.1	5.9	5.7	6.2	6.8	7.3	8.2	7.14
	56-sw	9.1	x	x	x	x	x	x	x	x	x	x	x	x
	76.2-sw	9.7	8.8	9.0	8.6	8.0	8.2	6.8	6.7	7.2	8.0	8.5	9.5	8.25
	118-sw	10.5	9.5	9.8	9.3	8.7	8.9	x	x	x	x	x	x	x
	119.9-sw	10.5	9.6	9.9	9.4	8.7	9.0	7.5	7.4	8.0	8.9	9.2	10.3	9.04
2052	10-se	6.0	5.8	6.2	5.9	5.7	5.9	4.7	4.5	4.8	5.2	5.3	6.0	5.50
	10-w	5.9	5.8	6.2	5.9	5.7	5.8	4.8	4.5	4.9	5.2	5.3	5.9	5.48
	30-se	7.8	7.3	7.6	7.3	7.0	7.1	5.8	5.6	6.0	6.5	6.8	7.5	6.85
	30-w	7.7	7.3	7.7	7.3	7.0	7.1	5.9	5.6	6.0	6.6	6.8	7.6	6.87
	49.6-se	8.5	7.9	8.2	7.9	7.6	7.6	x	x	x	x	x	x	x
	49.6-w	8.7	8.0	8.4	8.0	7.7	7.8	6.4	6.1	6.6	7.3	x	x	7.58
2163	10-se	5.6	5.8	5.8	5.8	5.6	6.0	4.3	4.1	4.3	4.9	4.8	5.4	5.19
	10-w	5.5	5.7	5.8	5.8	5.6	6.0	4.4	4.1	4.3	4.9	4.9	5.5	5.19
	30-se	7.3	7.2	7.3	7.2	6.9	7.2	5.5	5.4	5.7	6.3	6.5	7.2	6.63
	30-w	7.3	7.2	7.4	7.2	6.8	7.1	5.6	5.4	5.7	6.3	6.5	7.2	6.64
	49.6-se	8.4	x	x	x	x	x	x	x	x	x	x	x	x
	49.6-w	8.4	8.0	8.2	8.0	7.5	7.9	6.2	6.0	6.5	7.2	7.5	8.2	7.46
Abilene	10	4.9	5.1	5.3	5.2	5.3	5.1	4.1	3.9	4.2	4.4	4.4	4.8	4.73
Lubbock	10	5.6	5.9	5.9	6.0	5.7	5.9	4.5	4.3	4.1	4.9	4.8	5.3	5.23
Midland	10	4.6	5.3	5.3	5.4	5.1	5.6	4.5	4.4	4.4	4.4	3.9	4.5	4.78

Monthly Mean Wind Speeds (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2013

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	5.4	6.4	6.3	6.6	6.7	6.0	4.9	4.5	4.5	5.4	5.7		
	38.1-sw	6.7	7.9	7.6	7.9	8.0	7.1	6.0	5.6	5.6	6.6	7.0		
	56-sw	x	8.5	8.2	8.5	8.5	7.8	6.6	6.2	6.3	7.2	7.7		
	76.2-sw	7.6	8.9	8.7	8.9	9.0	8.2	7.0	6.7	6.7	7.7	8.2		
	118-sw	x	9.8	9.7	9.8	9.8	9.1	7.8	7.5	7.5	8.5	9.1		
	119.9-sw	8.2	9.7	9.6	9.7	9.7	9.0	7.8	7.5	7.5	x	x		
2052	10-se	4.9	5.9	5.9	6.4	6.6	6.3	5.0	4.4	4.4	5.1	5.4		
	10-w	4.8	5.9	6.1	6.6	6.8	6.4	5.1	4.5	4.5	5.3	5.5		
	30-se	6.1	7.3	7.3	7.8	7.9	7.4	6.1	5.6	5.7	6.5	6.9		
	30-w	6.1	7.3	7.3	7.8	8.0	7.4	6.1	5.6	5.7	6.6	7.0		
	49.6-se	x	8.1	8.0	8.4	8.6	8.0	6.7	6.2	6.3	7.2	7.7		
	49.6-w	x	8.1	8.1	8.4	8.6	8.0	6.7	6.2	6.3	7.2	7.7		
2163	10-se	4.7	5.9	5.7	6.2	6.3	6.2	4.7	4.2	4.3	4.8	5.0		
	10-w	4.7	5.9	5.8	6.2	6.4	6.2	4.7	4.2	4.3	4.9	5.2		
	30-se	6.1	7.5	7.3	7.6	7.7	7.3	5.9	5.5	5.5	6.3	6.6		
	30-w	6.2	7.5	7.3	7.6	7.8	7.3	5.8	5.4	5.5	6.2	6.5		
	49.6-se	x	8.2	8.0	8.3	8.4	7.9	6.5	6.1	6.2	7.0	7.3		
	49.6-w	x	8.3	8.1	8.4	8.5	8.0	6.6	6.2	6.3	7.1	7.4		
2164	10-w			5.9	6.3	6.5	6.4	4.9	4.5	4.5	5.1	5.4		
	32-se			7.4	7.7	7.9	7.4	6.0	5.6	5.7	6.4	6.7		
	32-w			7.4	7.7	7.9	7.5	6.0	5.6	5.7	6.4	6.8		
	50-w			8.0	8.3	8.5	8.0	6.6	6.2	6.3	7.0	7.5		
	59.2-se			8.3	8.6	8.7	8.2	6.8	6.4	6.5	7.3	7.8		
	59.2-w			8.3	8.6	8.8	8.2	6.8	6.4	6.5	7.4	7.8		
2165	10-w								4.3	4.2	5.0	5.3		
	32-se								5.7	5.6	6.6	7.0		
	32-w								5.8	5.7	6.6	7.0		
	50-w								6.4	6.3	7.3	7.8		
	59.2-se								6.6	6.5	7.5	8.0		
	59.2-w								6.6	6.5	7.5	8.0		
Abilene	10	4.1	5.1	5.6	6.4	5.9	5.1	3.9	3.8	3.7	4.5	4.7		
Lubbock	10	4.7	5.6	5.8	6.3	6.3	6.4	4.9	4.1	4.4	5.0	5.2		
Midland	10	4.1	5.0	5.3	5.9	6.1	6.2	4.9	4.5	4.4	4.6	4.6		

APPENDIX D

Prospective Turbine Coordinates, Mesquite Creek
GE-1.79/100 Turbines, 80-m Hub Height

Some of these locations have been staked, checked and finalized in the field, many of them are not yet finalized. No major changes are anticipated with this latter category of turbine.

Prospective 211.22-MW Array for GE-1.79/100 Turbines
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

Prepared by R. Simon and L. Pasley, November 2013
WGS84 Datum, Partially Field Checked

			UTM Zone 14S…		
Turbine	Latitude	Longitude	Easting	Northing	Elevation (ft ASL)
1	32.762604	-101.773145	240210	3628374	2942
2	32.762668	-101.769892	240515	3628373	2943
3	32.762700	-101.766639	240820	3628368	2943
4	32.762754	-101.763118	241151	3628366	2938
5	32.762797	-101.759596	241481	3628362	2931
6	32.762872	-101.756062	241812	3628361	2927
7	32.762904	-101.752541	242142	3628356	2922
8	32.763011	-101.749200	242456	3628360	2917
9	32.763128	-101.745845	242770	3628365	2915
10	32.763244	-101.742489	243085	3628370	2912
11	32.751214	-101.767549	240702	3627097	2945
12	32.751162	-101.762115	241211	3627078	2940
13	32.751167	-101.758145	241583	3627068	2933
14	32.751281	-101.754227	241951	3627071	2928
15	32.751532	-101.749572	242388	3627088	2926
16	32.751875	-101.744977	242819	3627115	2927
17	32.752240	-101.740895	243203	3627145	2923
18	32.753752	-101.736545	243615	3627303	2924
19	32.755544	-101.731965	244049	3627490	2920
20	32.754467	-101.728456	244375	3627362	2917
21	32.754493	-101.725025	244697	3627357	2921
22	32.753145	-101.722089	244968	3627200	2920
23	32.749515	-101.718951	245252	3626790	2923
24	32.744727	-101.742365	243044	3626316	2928
25	32.744727	-101.738069	243446	3626305	2927
26	32.744727	-101.734166	243812	3626296	2923
27	32.744622	-101.730008	244201	3626274	2917
28	32.726421	-101.795652	237995	3624416	2928
29	32.726040	-101.791184	238413	3624363	2929
30	32.728470	-101.785107	238990	3624617	2932

31	32.731716	-101.775290	239920	3624953	2938
32	32.731387	-101.771244	240298	3624907	2938
33	32.731047	-101.767213	240675	3624859	2935
34	32.734821	-101.761349	241235	3625263	2929
35	32.733244	-101.752675	242044	3625067	2928
36	32.735524	-101.747120	242571	3625307	2933
37	32.735009	-101.743421	242917	3625240	2933
38	32.734516	-101.739710	243263	3625177	2931
39	32.734001	-101.736024	243607	3625111	2928
40	32.733496	-101.732325	243952	3625046	2922
41	32.732981	-101.728639	244296	3624980	2917
42	32.732477	-101.724953	244641	3624915	2911
43	32.732506	-101.720994	245012	3624909	2913
44	32.732467	-101.717878	245304	3624897	2912
45	32.705145	-101.821574	235502	3622121	2925
46	32.709646	-101.807753	236811	3622586	2935
47	32.709402	-101.802325	237320	3622545	2935
48	32.709193	-101.796855	237832	3622508	2931
49	32.708949	-101.791551	238329	3622468	2925
50	32.716480	-101.776827	239731	3623267	2913
51	32.715554	-101.772564	240128	3623154	2925
52	32.715312	-101.767973	240558	3623116	2923
53	32.725053	-101.761438	241199	3624180	2931
54	32.724366	-101.757204	241594	3624094	2933
55	32.721856	-101.753047	241976	3623805	2937
56	32.720740	-101.748941	242358	3623671	2934
57	32.725544	-101.741000	243116	3624185	2931
58	32.725031	-101.736838	243505	3624118	2918
59	32.724323	-101.732948	243868	3624030	2913
60	32.723604	-101.729058	244230	3623941	2906
61	32.722896	-101.725156	244594	3623853	2905
62	32.722261	-101.721471	244938	3623773	2902
63	32.713873	-101.740308	243148	3622889	2914
64	32.713873	-101.736074	243545	3622878	2900
65	32.714174	-101.731909	243936	3622902	2894
66	32.713251	-101.727836	244315	3622790	2896
67	32.712194	-101.724508	244624	3622664	2892
68	32.689044	-101.821395	235472	3620334	2917
69	32.688392	-101.816490	235930	3620250	2920
70	32.687741	-101.811958	236353	3620166	2923
71	32.687089	-101.807426	236776	3620083	2925
72	32.686220	-101.802354	237249	3619974	2916
73	32.695948	-101.786537	238761	3621014	2920
74	32.695224	-101.782148	239170	3620923	2917
75	32.694427	-101.777903	239566	3620824	2917
76	32.699304	-101.771109	240218	3621348	2914
77	32.698122	-101.767028	240597	3621207	2913
78	32.695634	-101.762962	240971	3620921	2908

79	32.695490	-101.758659	241374	3620894	2905
80	32.699186	-101.753761	241844	3621292	2905
81	32.698756	-101.749543	242238	3621235	2908
82	32.698317	-101.745298	242635	3621175	2912
83	32.698274	-101.741465	242995	3621161	2912
84	32.696624	-101.736999	243409	3620968	2910
85	32.694991	-101.733829	243701	3620779	2900
86	32.693349	-101.730642	243995	3620589	2901
87	32.658319	-101.811930	236269	3616903	2907
88	32.657354	-101.807164	236713	3616784	2912
89	32.667452	-101.794531	237928	3617873	2907
90	32.666252	-101.790621	238291	3617730	2904
91	32.665787	-101.784659	238849	3617664	2900
92	32.667536	-101.778601	239423	3617843	2905
93	32.666251	-101.774709	239784	3617691	2897
94	32.664177	-101.771044	240122	3617452	2888
95	32.662085	-101.767192	240477	3617211	2887
96	32.681580	-101.730954	243932	3619284	2871
97	32.680759	-101.726789	244321	3619183	2868
98	32.688769	-101.722188	244775	3620061	2892
99	32.684558	-101.718105	245146	3619584	2880
100	32.709856	-101.711480	245839	3622374	2889
101	32.707728	-101.709203	246047	3622132	2890
102	32.705328	-101.705981	246342	3621858	2890
103	32.702681	-101.703195	246596	3621558	2882
104	32.701535	-101.718741	245135	3621468	2862
105	32.701086	-101.714839	245499	3621409	2877
106	32.705814	-101.690000	247842	3621874	2875
107	32.707415	-101.685194	248297	3622040	2883
108	32.699497	-101.686765	248128	3621166	2875
109	32.698193	-101.682692	248506	3621011	2880
110	32.695629	-101.711876	245762	3620797	2883
111	32.694628	-101.706856	246230	3620674	2855
112	32.694619	-101.699292	246939	3620655	2864
113	32.692802	-101.696397	247205	3620446	2878
114	32.691193	-101.693108	247509	3620260	2877
115	32.690088	-101.689438	247850	3620129	2872
116	32.689736	-101.685607	248209	3620080	2871
117	32.686644	-101.681906	248547	3619729	2860
118	32.684886	-101.677781	248929	3619524	2855

APPENDIX E

Turbulence Intensity

Turbulence intensity summaries are presented for five Mesquite Creek meteorological towers. These turbulence statistics are calculated for the highest measurement level on each tower, except Site 6341, whose turbulence data come from the 76-m level.

The turbulence data were computed from hourly data records. However, the standard deviations in the raw data files reflect 10-minute turbulence due to the processing algorithm of the Symphonie Data Retriever software. Essentially the six 10-minute individual standard deviations are combined using the root-mean-square method.

Turbulence Intensity Analysis
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America
Site 6341, 76-m Level
Using Hourly Data from June 2005-November 2013*

Speed (mps)	Number of Hours	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Maximum T. I.
0	38	0.354	0.115	0.469	0.596
1	541	0.388	0.128	0.516	0.773
2	1535	0.276	0.116	0.392	0.590
3	3023	0.209	0.095	0.304	0.525
4	4727	0.166	0.080	0.246	0.487
5	6064	0.140	0.069	0.209	0.545
6	6812	0.119	0.059	0.178	0.433
7	7180	0.107	0.054	0.161	0.440
8	6573	0.095	0.047	0.142	0.378
9	5860	0.087	0.044	0.131	0.372
10	4720	0.078	0.041	0.119	0.327
11	3876	0.074	0.040	0.114	0.397
12	3109	0.068	0.039	0.107	0.290
13	2429	0.064	0.038	0.102	0.255
14	1915	0.057	0.036	0.093	0.271
15	1295	0.055	0.036	0.091	0.290
16	876	0.052	0.035	0.087	0.145
17	478	0.052	0.035	0.087	0.147
18	241	0.058	0.037	0.095	0.156
19	93	0.068	0.033	0.101	0.126
20	43	0.080	0.043	0.123	0.280
21	22	0.082	0.032	0.114	0.125
22	14	0.098	0.016	0.114	0.134
23	9	0.100	0.019	0.119	0.130
24	4	0.104	0.032	0.136	0.150
25	0				
26+	3	0.082	0.004	0.086	0.085
Total	61480				

Turbulence Intensity Analysis
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America
Site 2052, 49.6-m Level, West Boom
Using Hourly Data from July 2009-November 2013*

Speed (mps)	Number of Hours	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Maximum T. I.
0	35	0.381	0.129	0.510	0.694
1	362	0.404	0.140	0.544	0.790
2	1147	0.288	0.127	0.415	0.670
3	2112	0.209	0.107	0.316	0.625
4	3023	0.166	0.088	0.254	0.494
5	3930	0.142	0.074	0.216	0.521
6	4309	0.123	0.062	0.185	0.404
7	4352	0.109	0.054	0.163	0.363
8	3906	0.096	0.048	0.144	0.344
9	3250	0.089	0.045	0.134	0.292
10	2703	0.082	0.043	0.125	0.282
11	2113	0.077	0.042	0.119	0.376
12	1632	0.073	0.039	0.112	0.231
13	1225	0.069	0.039	0.108	0.318
14	714	0.069	0.036	0.105	0.179
15	377	0.076	0.036	0.112	0.172
16	173	0.088	0.031	0.119	0.166
17	79	0.101	0.020	0.121	0.161
18	40	0.111	0.035	0.146	0.294
19	18	0.110	0.023	0.133	0.153
20	10	0.116	0.032	0.148	0.201
21	7	0.121	0.012	0.133	0.138
22	0				
23	0				
24	0				
25	0				
26+	0				
Total	35517				

Turbulence Intensity Analysis
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America
Site 2163, 49.6-m Level, West Boom
Using Hourly Data from November 2009-November 2013*

Speed (mps)	Number of Hours	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Maximum T. I.
0	37	0.364	0.126	0.490	0.609
1	310	0.407	0.142	0.549	0.859
2	855	0.292	0.125	0.417	0.627
3	1654	0.208	0.110	0.318	0.618
4	2608	0.158	0.087	0.245	0.535
5	3605	0.130	0.075	0.205	0.422
6	4415	0.111	0.064	0.175	0.579
7	4779	0.096	0.053	0.149	0.369
8	4530	0.085	0.047	0.132	0.361
9	3768	0.081	0.043	0.124	0.425
10	2719	0.079	0.040	0.119	0.285
11	1951	0.079	0.036	0.115	0.233
12	1285	0.084	0.036	0.120	0.300
13	681	0.089	0.029	0.118	0.174
14	415	0.097	0.022	0.119	0.173
15	220	0.097	0.017	0.114	0.151
16	101	0.101	0.018	0.119	0.179
17	72	0.103	0.016	0.119	0.181
18	50	0.103	0.017	0.120	0.164
19	20	0.106	0.025	0.131	0.167
20	13	0.097	0.013	0.110	0.122
21	3	0.102	0.020	0.122	0.125
22	5	0.115	0.041	0.156	0.186
23	3	0.087	0.001	0.088	0.088
24	1	0.094			0.094
25	0				
26+	1	0.122			0.122
Total	34101				

Turbulence Intensity Analysis
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America
Site 2164, 59.2-m Level, West Boom
Using Hourly Data from March-November 2013*

Speed (mps)	Number of Hours	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Maximum T. I.
0	2	0.628	0.122	0.784	0.714
1	39	0.469	0.124	0.628	0.672
2	136	0.336	0.120	0.490	0.630
3	301	0.256	0.096	0.379	0.496
4	456	0.202	0.088	0.315	0.539
5	601	0.157	0.074	0.251	0.411
6	771	0.136	0.064	0.219	0.445
7	888	0.110	0.054	0.179	0.363
8	869	0.098	0.047	0.159	0.290
9	765	0.088	0.044	0.143	0.346
10	579	0.085	0.037	0.132	0.233
11	366	0.083	0.034	0.127	0.186
12	270	0.084	0.031	0.123	0.200
13	161	0.089	0.028	0.125	0.178
14	74	0.090	0.026	0.123	0.148
15	40	0.096	0.022	0.124	0.152
16	22	0.101	0.021	0.128	0.172
17	14	0.092	0.011	0.106	0.124
18	11	0.099	0.020	0.125	0.148
19	5	0.092	0.014	0.110	0.116
20	2	0.125	0.003	0.129	0.127
21	1	0.219			0.219
22	1	0.103			0.103
23	0				
24	0				
25	0				
26+	0				
Total	6374				

Turbulence Intensity Analysis
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America
Site 2165, 59.2-m Level, West Boom
Using Hourly Data from August-November 2013*

Speed (mps)	Number of Hours	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Maximum T. I.
0	3	0.372	0.140	0.512	0.500
1	25	0.503	0.144	0.647	0.775
2	80	0.297	0.111	0.408	0.595
3	155	0.241	0.094	0.335	0.493
4	222	0.184	0.077	0.261	0.397
5	262	0.149	0.066	0.215	0.381
6	270	0.125	0.051	0.176	0.324
7	290	0.113	0.048	0.161	0.261
8	301	0.103	0.040	0.143	0.247
9	251	0.086	0.039	0.125	0.259
10	174	0.082	0.036	0.118	0.161
11	136	0.078	0.035	0.113	0.142
12	97	0.081	0.034	0.115	0.140
13	52	0.080	0.031	0.111	0.144
14	29	0.074	0.032	0.106	0.128
15	12	0.062	0.035	0.097	0.130
16	3	0.082	0.050	0.132	0.113
17	0				
18	0				
19	0				
20	0				
21	0				
22	0				
23	0				
24	0				
25	0				
26+	0				
Total	2362				

APPENDIX F

Monthly Extreme Gusts

Monthly maximum observed 2-second gusts are listed herein. They are derived from the NRG raw data files. The same color coding for data recovery applies as in Appendix C. The overall maximum observed gust has been 44 mps.

Peak 2-Second Gusts (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2005

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne						16	28	26	20	21	31	25	31
	38-sw						16	28	25	20	21	31	24	31
	56.4-ne						17	28	25	20	21	32	26	32
	56.4-sw						16	27	26	20	21	31	25	31
	75.6-ne						18	29	25	20	21	32	25	32
	75.6-sw						17	30	26	20	21	31	25	31

YEAR: 2006

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne	31	21	27	29	24	26	24	24	22	24	27	23	31
	38-sw	31	21	26	28	23	26	24	23	21	24	27	23	31
	56.4-ne	29	21	28	29	26	27	24	24	23	24	27	23	29
	56.4-sw	29	22	26	28	26	28	24	23	23	24	26	23	29
	75.6-ne	30	22	28	29	25	29	24	24	24	25	27	24	30
	75.6-sw	30	24	28	29	25	30	24	23	23	26	29	24	30
2031	20					26	25	25	20	20	21	23	21	26
	40					26	26	24	22	22	22	25	23	26
	59.5-w					26	27	24	22	21	23	26	24	27
	59.5-e					26	17	24	22	21	23	26	24	26
2029	20						29	27	28	x	x	x	x	29
	40						33	28	26	x	x	x	x	33
	59.5-w						32	27	24	x	x	x	x	32
	59.5-e						32	27	24	x	x	x	x	32
2052	20											25	21	25
	40											26	23	26
	58-w											26	23	26
	58-e											26	24	26

Peak 2-Second Gusts (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2007

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne	20	35	23	24	27	32	26	19	27	26	20	24	35
	38-sw	20	34	23	23	27	32	28	19	26	26	20	23	34
	56.4-ne	21	36	25	24	27	32	27	20	26	25	20	24	36
	56.4-sw	21	33	x	x	x	x	x	x	x	x	x	x	33
	75.6-ne	24	37	23	24	27	32	27	20	26	25	21	25	37
	75.6-sw	23	34	24	24	28	32	27	19	25	24	21	26	34
2031	20	19	32	24	26	25	30	34	19	23	21	x	x	34
	40	20	34	24	27	29	33	32	22	24	22	x	x	34
	59.5-w	21	35	24	27	29	33	31	24	25	23	x	x	35
	59.5-e	21	34	24	28	28	17	31	24	22	23	x	x	34
2029	20	16	33	22	x	x	x	x	19	18	15	x	x	33
	40	16	36	23	x	x	x	x	19	20	15	x	x	36
	59.5-w	17	35	24	x	x	x	x	20	21	15	x	x	35
	59.5-e	16	36	24	x	x	x	x	20	21	16	x	x	36
2052	20	19	33	22	27	32	34	22	18	26	22	18	21	34
	40	20	34	23	28	35	34	23	20	28	23	20	22	35
	58-w	21	33	23	28	37	36	24	20	27	23	21	23	37
	58-e	22	34	23	29	37	36	24	21	26	23	21	23	37

YEAR: 2008

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	38-ne	30	23	25	31	28	x	x	x	x	x			31
	38-sw	31	23	24	29	28	x	x	x	x	x			31
	56.4-ne	31	23	27	30	29	x	x	x	x	x			31
	56.4-sw	x	x	x	x	x	x	x	x	x	x			
	75.6-ne	31	22	26	31	x	x	x	x	x	x			31
	75.6-sw	31	23	26	30	x	x	x	x	x	x			31
2031	All levels	x	x	x	x	x	x	x	x	x	x			
2029	20	x	x	x	x	x	x	15	23	21	18			23
	40	x	x	x	x	x	x	17	26	16	19			26
	59.5-w	x	x	x	x	x	x	x	x	x	x			
	59.5-e	x	x	x	x	x	x	18	26	16	19			26
2052	20	27	23	24	26	28	27	20	24	17	18			28
	40	29	25	24	28	29	27	20	26	17	18			29
	58-w	29	24	25	28	29	29	20	25	17	19			29
	58-e	29	25	25	29	30	29	20	26	18	20			30

Peak 2-Second Gusts (mps)

Mesquite Creek, Texas

BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2009

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw						16	31	29	27	20	20	34	34
	38.1-sw						18	34	30	29	21	21	36	36
	56-sw						19	33	30	31	21	21	37	37
	76.2-sw						20	31	30	32	21	21	38	38
	118-sw						19	30	30	34	21	24	40	40
	119.6-sw						18	29	30	33	22	23	39	39
2052	10-se							29	27	24	17	17	31	31
	10-w							28	37	24	18	16	30	37
	30-se							32	29	26	19	18	34	34
	30-w							32	30	26	19	19	33	33
	49.6-se							33	31	28	19	20	34	34
	49.6-w							34	31	28	20	20	34	34
2163	10-se											18	31	31
	10-w											18	32	32
	30-se											20	37	37
	30-w											20	36	36
	49.6-se											21	38	38
	49.6-w											21	37	37

YEAR: 2010

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	25	20	24	24	27	28	18	17	23	22	23	25	28
	38.1-sw	26	21	28	26	28	31	20	18	25	23	25	28	31
	56-sw	26	21	28	26	29	31	21	19	26	23	25	29	31
	76.2-sw	27	21	28	26	30	32	21	20	26	24	24	29	32
	118-sw	28	21	30	24	29	33	22	20	28	24	23	31	33
	119.6-sw	28	21	30	24	28	33	22	21	28	24	23	31	33
2052	10-se	23	20	24	23	24	28	18	18	21	21	20	24	28
	10-w	23	20	24	22	24	28	17	18	21	22	21	23	28
	30-se	25	21	26	24	26	32	19	20	23	24	23	27	32
	30-w	24	21	25	25	26	31	19	20	23	25	23	26	31
	49.6-se	26	21	26	25	27	34	18	21	24	26	26	28	34
	49.6-w	26	21	26	25	28	33	20	20	24	26	26	27	33
2163	10-se	25	20	23	27	24	25	19	28	20	20	19	23	28
	10-w	25	20	23	28	24	26	19	28	20	20	19	22	28
	30-se	29	20	26	27	26	29	21	30	23	23	22	24	30
	30-w	29	20	26	27	26	28	21	31	23	22	22	24	31
	49.6-se	30	21	28	27	26	28	21	30	24	23	22	25	30
	49.6-w	30	21	28	27	26	28	21	31	24	23	21	25	31

Peak 2-Second Gusts (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2011

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	22	26	23	23	25	21	26	21	17	28	25	21	28
	38.1-sw	23	28	23	25	25	22	28	20	20	30	26	23	30
	56-sw	23	29	24	26	27	24	27	22	20	29	24	23	29
	76.2-sw	23	29	24	27	28	24	28	19	20	31	26	24	31
	118-sw	24	29	24	27	28	26	31	20	21	31	29	26	31
	119.6-sw	25	29	24	28	28	26	30	20	21	31	29	26	31
2052	10-se	19	26	20	24	24	19	25	21	21	27	24	22	27
	10-w	19	25	21	23	23	19	26	20	21	27	23	23	27
	30-se	21	28	22	25	26	21	28	25	23	31	26	23	31
	30-w	20	28	22	26	26	21	28	25	22	31	26	23	31
	49.6-se	21	28	23	26	26	23	28	23	24	31	28	24	31
	49.6-w	21	28	23	25	26	23	28	23	23	31	28	24	31
2163	10-se	20	25	21	23	24	24	29	22	20	26	24	21	29
	10-w	20	24	21	23	24	23	28	22	19	27	24	21	28
	30-se	22	28	23	24	26	26	28	24	22	30	26	23	30
	30-w	23	28	22	24	26	25	27	24	20	31	26	23	31
	49.6-se	23	27	24	25	26	26	28	24	23	31	25	24	31
	49.6-w	23	27	23	24	26	26	28	24	23	31	26	24	31

YEAR: 2012

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	26	25	24	23	20	26	22	21	25	29	20	27	29
	38.1-sw	26	26	26	24	20	28	22	24	28	31	21	28	31
	56-sw	25	x	x	x	x	x	x	x	x	x	x	x	25
	76.2-sw	28	27	27	25	21	30	21	23	26	33	22	29	33
	118-sw	28	27	28	26	22	34	x	x	x	x	x	x	34
	119.6-sw	28	27	28	26	22	34	21	24	28	34	21	29	34
2052	10-se	24	24	31	23	20	23	21	18	23	28	19	26	31
	10-w	23	23	31	23	21	23	21	18	22	27	18	26	31
	30-se	26	26	34	24	21	28	23	20	24	31	21	28	34
	30-w	26	26	34	24	20	28	22	20	24	31	21	28	34
	49.6-se	27	28	34	24	21	28	x	x	x	x	x	x	34
	49.6-w	27	27	34	25	22	28	22	21	24	31	x	x	34
2163	10-se	24	25	25	21	19	25	24	19	18	29	21	25	29
	10-w	24	24	26	21	19	25	24	18	19	29	21	26	29
	30-se	26	26	28	24	20	26	24	20	20	30	24	27	30
	30-w	26	25	28	24	20	27	24	20	21	31	24	27	31
	49.6-se	26	x	x	x	x	x	x	x	x	x	x	x	26
	49.6-w	26	26	29	24	20	27	22	20	20	31	23	28	31

Peak 2-Second Gusts (mps)
Mesquite Creek, Texas
BNB Renewable Energy LLC/Sumitomo Corporation of America

YEAR: 2013

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
6341	14.9-sw	24	28	27	27	24	37	21	20	18	20	19		37
	38.1-sw	25	32	29	28	29	41	22	21	18	21	20		41
	56-sw	x	32	29	29	29	41	23	21	19	21	20		41
	76.2-sw	26	33	29	28	29	41	22	22	20	21	21		41
	118-sw	x	35	30	29	31	42	23	22	21	22	23		42
	119.6-sw	26	36	31	29	31	43	22	23	21	x	x		43
2052	10-se	24	28	25	24	24	36	20	19	19	18	20		36
	10-w	23	29	26	25	24	37	21	19	19	19	20		37
	30-se	25	30	26	26	26	41	23	20	21	20	23		41
	30-w	25	31	28	28	27	42	22	21	21	20	22		42
	49.6-se	x	32	28	28	28	44	22	21	21	20	22		44
	49.6-w	x	32	28	28	27	43	23	21	21	20	22		43
2163	10-se	24	28	27	24	24	30	21	22	17	18	20		30
	10-w	23	28	28	25	24	31	21	23	17	19	19		31
	30-se	25	30	28	28	26	32	22	25	19	20	20		32
	30-w	25	31	28	28	26	34	22	25	19	20	20		34
	49.6-se	x	31	28	28	28	34	23	26	20	20	21		34
	49.6-w	x	32	28	28	29	36	23	26	20	20	21		36
2164	10-w			26	26	28	31	22	22	17	18	21		31
	32-se			28	30	28	32	24	24	18	20	21		32
	32-w			28	30	28	35	24	25	18	20	21		35
	50-w			30	31	30	35	24	25	18	20	22		35
	59.2-se			30	31	31	34	24	24	19	20	22		34
	59.2-w			30	31	31	35	24	26	18	20	21		35
2165	10-w								15	18	18	18		18
	32-se								16	20	21	22		22
	32-w								16	20	20	21		21
	50-w								16	21	21	22		22
	59.2-se								16	20	22	21		22
	59.2-w								16	20	22	21		22

Overall maximum for entire period: 44 mps